# Combined Sewer Overflow Characterization Report

## Consent Decree NO. 2:16CV512-PPS
## NPDES Permit No. IN0022977

Gary Sanitary District

| Document History | |
|---|---|
| Submittal | July 17, 2018 |
| Revision 1.0 | January 31, 2019 |

CDM Smith

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# Abbreviations and Acronyms

| | |
|---|---|
| AOC | area of concern |
| AUID | assessment unit ID |
| BEACON | Beach Advisory and Closing On-line Notification |
| BOD | biological oxygen demand |
| BSF | base sanitary flow |
| Cl | chloride |
| CBOD | chemical biochemical oxygen demand |
| CCC | continuous criterion concentrations |
| cf | cubic feet |
| cfs | cubic feet per second |
| CFU | colony forming unit |
| CMC | criterion maximum concentration |
| CN | free cyanide |
| CSO | combined sewer overflow |
| CSS | combined sewer system |
| CWA | Clean Water Act |
| d | day |
| DEQ | Department of Environmental Quality |
| DO | dissolved oxygen |
| EMC | event mean concentrations |
| ft | foot/feet |
| GCR | Grand Calumet River |
| GIS | Geographic Information System |
| gpd / sf | gallons per day per square feet |
| gpm | gallons per minute |
| GSD | Gary Sanitary District |
| GWI | groundwater infiltration |
| Hg | Mercury |
| hr | hour |
| HSD | Hobart Sanitary District |
| HUC | hydrologic cataloging units |
| IBC | Impaired Biotic Communities |
| IDEM | Indiana Department of Environmental Management |
| IDNR | Indiana Department of Natural Resources |
| IEPA | Illinois Environmental Protection Agency |

| | |
|---|---|
| IHCD | Independence Hill Conservancy District |
| in. | inch |
| ISS | inert suspended solids |
| lb | pound |
| lb / day | pounds per day |
| LCR | Little Calumet River |
| LSSD | Lake Station Sanitary District |
| LTCP | long term control plan |
| m | meter |
| MCD | Merrillville Conservancy District |
| MDEQ | Michigan Department of Environmental Quality |
| MG | million gallons |
| mg/L | milligrams per liter |
| MGD | million gallons per day |
| mL | milliliter |
| MLSS | mixed liquor suspended solids |
| MPN | most probable number |
| MRO | Monthly Report of Operations |
| MS4 | municipal separate storm sewer systems |
| N/A | not applicable |
| NH3 | ammonia |
| NIRPC | Northwest Indiana Regional Planning Commission |
| NOAA | National Oceanic and Atmospheric Administration |
| NPDES | National Pollutant Discharge Elimination System |
| NPS | National Park Service |
| NRT | National Recreation Trail Database |
| NWIS | National Water Information System |
| O&G | oil and grease |
| PAH | polycyclic aromatic hydrocarbon |
| PCB | polychlorinated biphenyls |
| PCCM | Post Construction Compliance Monitoring |
| POC | pollutants of concern |
| PRAWN | Program tracking, beach Advisories, Water quality standards, and Nutrients |
| PVC | polyvinyl chloride |
| QAPP | Quality Assurance Project Plan |
| RAD | Reach Address Database |
| RAS | return activated sludge |

| | |
|---|---|
| RDI/I | rainfall dependent inflow and infiltration |
| SIU | significant industrial user |
| SLR | solids loading rate |
| SOR | surface overflow rate |
| SRCER | Stream Reach Characterization and Evaluation Report |
| STORET | STOage and RETrieval |
| SWMM | Storm Water Management Model |
| TGS | temperature gradient study |
| TMDL | total maximum daily load |
| Total P | total phosphorus |
| TSS | total suspended solids |
| UAA | Use Attainability Analysis |
| USACE | United States Army Corps of Engineers |
| USDOJ | United States Department of Justice |
| USEPA | United States Environmental Protection Agency |
| USGS | United States Geological Survey |
| WEF MOP | Water Environment Federation Manual of Practice |
| WLA | wasteload allocation |
| WQ | water quality |
| WQX | Water Quality Exchange |
| WWTP | wastewater treatment plant |

# Preamble

The Gary Sanitary District (GSD) is in the process of developing its Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP), in accordance with Consent Decree No. 2:16CV512-PPS, effective date 3/19/2018. GSD has been actively working with the United States Environmental Protection Agency (USEPA) and the Indiana Department of Environmental Management (IDEM) to improve the operation of its wastewater treatment plant (WWTP) and combined sewer system (CSS) to reduce CSO discharges to the Little and Grand Calumet Rivers. Since starting this work, GSD has significantly reduced CSO discharges through collection system and WWTP improvements and operational changes. The Consent Decree directs the completion of the planning efforts for CSO control and reach final agreement with USEPA and IDEM.

## PR-1 Consent Decree Requirements

The current Consent Decree, effective date 3/19/2018, includes specific requirements for GSD to submit:

- Appendix 1 – CSO Operational Plan
- Appendix 2 – Stress Test Report
- Appendix 3 – CSO Long Term Control Plan, including the following intermediate reports as per Attachment 1 to Appendix 3:
    1. CSO Characterization Report
    2. Technology / Alternatives Screening
    3. Alternatives Analysis and Recommended Plan Evaluation, including Cost / Performance Analysis
    4. Financial Capability Assessment, including Recommended Plan CSO Control Measures
    5. Omitted in Consent Decree
    6. Long Term Control Plan – Draft and Final
    7. Post Construction Compliance Monitoring (PCCM) – Initial Hydraulic Model Validation Report
    8. PCCM – Hydraulic Model Recalibration and Validate Report
    9. PCCM – Water Quality Standards Assessment Report Related to Post Construction Compliance Monitoring
    10. PCCM – Final Post Construction Compliance Monitoring Report
    11. PCCM – Supplemental CSO Control Plan and Schedule to Address Performance Criteria

12. PCCM – Supplemental CSO Control Plan and Schedule to Address Water Quality Standards

- Appendix 4 – Ralston Street Lagoon
- Appendix 5 – Supplemental Environmental Project

# PR-2 CSO Planning Document History

Since 2007 the following documents the history of reports prepared by GSD for submittal to USEPA and IDEM:

**Table PR.1 Report History**

| Date | Document Title |
|---|---|
| 2/2004 | CSO LTCP Public Participation Interim Submittal, Appendix A Volumes I, II, and III |
| 2/2008 | Supplemental Flow Monitoring and Stormwater Management Model (SWMM) Re-Calibration |
| 6/2011 | Model Calibration Report:<br>Volume 1 – Collection System Model<br>Volume 2 – Little Calumet and Grand Calumet Receiving Water Models |
| 4/9/2012 | Draft Financial Capability Analysis |
| 11/16/2012 | Final Typical Year Determination and Baseline Conditions Modeling Memorandum |
| 11/21/2012 | Draft CSO Characterization Report |
| 7/9/2013 | Interim CSO Characterization and Sensitive Areas Report |
| 7/15/2013 | Peak Flow Modeling and Stress Testing Work Plan |
| 8/9/2013 | Quality Assurance Project Plan (QAPP) Water Quality Monitoring Study for Grand Calumet and Little Calumet River |
| 9/18/2013 | Wet Weather Sampling Event Report |
| 10/3/2013 | Temperature Gradient Study |
| 10/15/2013 | August 2013 Fixed Day Report |
| 10/30/2013 | Wet Weather Sampling Event Report |
| 11/13/2013 | September 2013 Fixed Day Report |
| 12/13/2013 | October 2013 Fixed Day Report |
| 1/14/2014 | Final Draft CSO Characterization and Sensitive Areas Report |
| 8/1/2014 | Draft Interim Peak Flow Modeling and Stress Testing Report |
| 10/31/2014 | Draft CSO Technology Screening |
| 5/18/2018 | CSO Operational Plan |
| 5/18/2018 | Public and Regulatory Agency Participation Plan |
| 7/17/2018 | CSO Characterization Report |
| 7/17/2018 | Stress Test Report |
| 1/31/2019 | CSO Characterization Report – Revision 1.0 |

## PR-3 Current Submittal

The attached report is being submitted in fulfillment of:

- Report Name: **CSO Characterization Report, Revision 1.0**
- Section: **VIII**
- Paragraph: **19 and 21**
- Appendix: **Appendix 3 Item I**
- USEPA Comments: 11/29/2018

# Section 1

# Introduction

The Gary Sanitary District (GSD) is in the process of developing its Combined Sewer Overflow (CSO) Long Term Control Plan (LTCP), in accordance with Consent Decree No. 2:16CV512-PPS, effective date 3/19/2018. In support of LTCP development, CDM Smith Inc. (CDM Smith) has prepared a Collection System Model and Receiving Water Quality Models to be used in developing an existing conditions assessment, baseline conditions, and CSO water quality assessments.

The Collection System and Receiving Water Quality Models were approved on September 25, 2011 by the United States Environmental Protection Agency (USEPA) and the Indiana Department of Environmental Management (IDEM). The model calibration report and USEPA approval letter are presented in **Appendix 5-1**.

A technical memorandum describing the selection of the typical year for baseline conditions was approved by USEPA/IDEM on November 1, 2012. The typical year memorandum and USEPA approval letter are presented in **Appendix 5-3**.

A Final Draft CSO Characterization and Sensitive Areas Report was submitted by GSD on January 14, 2014 and is presented in **Appendix 1-1**.

GSD submitted its CSO Characterization Report on 7/17/2018, in accordance with the requirements of the 3/19/2018 Consent Decree. USEPA reviewed that report and submitted comments to GSD on 11/29/2018. Subsequent to receipt of those comments, GSD held a comment review call with USEPA, IDEM, and USDOJ on 12/19/2018. All comments were discussed and resolved, and GSD is submitting this current CSO Characterization Report, 1/31/2019, in accordance with the consensus resolution discussed for each comment during that call.

**Appendix 7-1** presents a Response to Comments Memorandum dated 1/31/2019, and **Appendix 7-2** presents USEPA's Comment letter dated 11/29/2018.

The CSO Characterization Report is being submitted for final approval and is divided into the following sections:

- Section 1 – Introduction
- Section 2 – Collection System, Service Area, and Wastewater Treatment Plant (WWTP)
- Section 3 – Receiving Waters and Water Quality
- Section 4 – Sensitive Areas and Beneficial Uses
- Section 5 – CSO Discharge Characteristics

- Section 6 – Impacts to Receiving Waters
- Section 7 - Summary

Additional temperature, flow and receiving water data was collected during the summer and fall of 2013 to further validate the receiving water models and confirm the current conditions of the rivers. This information was submitted in Fall 2013, and is presented in **Appendix 3-2**. The models were updated to include the 2013 data and this report has been updated to reflect the additional monitoring data and the additional verification of the ability of the models to accurately predict current conditions.

# Section 2

# Collection System, Service Area, and Wastewater Treatment Plant (WWTP)

This section describes the GSD's collection system and service area, including:

- Services
- Service Area
- Collection System (Sewer, Pump Station, and CSO Regulator)
- Service Area Population
- Wastewater Treatment Plant (Capacity, Operation and Deficiency)
- Previous 5 Years of Flow Statistics
- Significant Industrial Users

## 2.1 Services

GSD owns, operates and maintains a wastewater treatment plant (WWTP), a 399-mile sewer collection system network, 27 active pump stations, and 11 CSO outfalls to provide conveyance and treatment services for the City of Gary. Through service agreements with the City of Hobart, the City of Lake Station and the Merrillville Conservancy District, GSD also collects sewage from surrounding communities of the City of Hobart, City of Lake Station, Town of Merrillville, which own, operate and maintain their respective collection system networks to include Town of New Chicago, and Wheeler and Duck Creek subdivision of Porter County.

## 2.2 Service Area

GSD collects and treats wastewater from the predominately combined sewer areas in the City of Gary and the separated sewer areas in the communities of the City of Hobart, City of Lake Station, Town of Merrillville. **Table 2-1** summarizes the general service area and sewered area of GSD and its satellite communities (also known as "satellites"). **Figure 2-1** presents the general boundaries of the geographical service area, combined vs. separate sewer system areas, major trunk sewers, and connection points of satellites. Service area is defined as the general boundary for each respective sewer district, and includes both sewered and non-sewered areas. Only the sewered areas (combined and sanitary sewer areas) contribute flows to GSD's WWTP. GSD's service area boundary was delineated based on GSD's sewer atlases while the satellites' service area boundaries were based on maps provided by the respective communities in response to USEPA's Section 308 Information Request in 2014. Sewered areas were delineated based on sewer data provided by GSD and the satellite communities.

**Table 2-1. GSD and Satellite Service Areas**

| Community | Service Area[1] (acre) | Combined Sewer Area | | Sanitary Sewer Area | | Storm Sewer Area | |
|---|---|---|---|---|---|---|---|
| | | acre | percent | acre | percent | acre | percent |
| ***Gary Sanitary District (GSD)*** | | | | | | | |
| City of Gary | 32,000 | 11,100 | 35 | 4,600 | 14 | 2,790 | 9 |
| City of Hobart | 170 | 0 | 0 | 140 | 83 | Not served by GSD | |
| Town of Merrillville | 440 | 0 | 0 | 440 | 100 | | |
| ***Hobart Sanitary District (HSD) (satellite of GSD)*** | | | | | | | |
| City of Hobart | 12,970 | 0 | 0 | 4,700 | 36 | Not served by GSD | |
| Pine Village trailer park (satellite of HSD) | 30 | 0 | 0 | 30 | 100 | | |
| Wheeler & Duck Creek subdivision, White Oak Conservancy District (satellite of HSD) | 154 | 0 | 0 | 154 | 100 | | |
| ***Lake Station Sanitary District (LSSD) (satellite of GSD)*** | | | | | | | |
| City of Lake Station | 3,230 | 0 | 0 | 2,700 | 84 | Not served by GSD | |
| City of New Chicago (satellite of LSSD) | 401 | 0 | 0 | 360 | 89 | | |
| ***Merrillville Conservancy District (MCD) (satellite of GSD)*** | | | | | | | |
| City of Hobart | 3,880 | 0 | 0 | 1,420 | 37 | Not served by GSD | |
| Town of Merrillville | 9,570 | 0 | 0 | 4,870 | 51 | | |
| ***Independence Hill Conservancy District (IHCD) (satellite of MCD)*** | | | | | | | |
| Town of Merrillville | 3,490 | 0 | 0 | 2,090 | 60 | Not served by GSD | |

**Note:**

(1) Service area includes the combined sewer area, sanitary sewer area, storm sewer area and non-sewered area.

# 2.3 Collection System

## 2.3.1 Sewer Network

GSD has approximately 399 miles of gravity sewers and force mains mostly within the city of Gary while satellite communities operate and maintain their respective sewer systems. **Table 2-2** summarizes the lengths of sewers and force mains in GSD and satellite communities. **Figure 2-2** shows the GSD collection system network. The system's interceptor sewers (36 inches in diameter or larger) comprise approximately 52 miles.

The oldest sewers in the City of Gary are over 100 years old (as of 2018). The average age of the sewers in Gary is approximately 84 years old. Sewers in Gary are made of vitrified clay, concrete, reinforced concrete, brick, and polyvinyl chloride (PVC). Sewers in Gary are between 6 and 20 feet deep, with an average depth of approximately 9 feet.

**Table 2-2. Length of Sewers (miles) in GSD Service Area**

| Gary Sanitary District | | | | | |
|---|---|---|---|---|---|
| **Equivalent Diameter** | **Gravity Sewer** | **Force Main** | | | |
| <8 inches | 33.7 | 2.3 | | | |
| 9 – 18 inches | 254.8 | 1.6 | | | |
| 19 – 36 inches | 52.9 | 0.8 | | | |
| 37 – 54 inches | 25.2 | 1.0 | | | |
| 55 – 72 inches | 18.5 | 0 | | | |
| 73 – 90 inches | 5.0 | 0 | | | |
| > 90 inches | 4.0 | 0 | | | |
| **Total** | **394.1** | **5.7** | | | |
| **Hobart Sanitary District** | | | **Lake Station Sanitary District** | | |
| **Diameter** | **Gravity Sewer** | **Force Main** | **Diameter** | **Gravity Sewer** | **Force Main** |
| <8 inches | 32.1 | 4.5 | <8 inches | 40.3 | 4.6 |
| 9 – 18 inches | 61.6 | 0.1 | 9 – 18 inches | 18.4 | 3.4 |
| 19 – 36 inches | 2.1 | 3.7 | 19 – 36 inches | 1.7 | 0 |
| > 36 inches | 0 | 0 | > 36 inches | 0 | 0 |
| Unknown | 10.6 | 4.2 | | | |
| **Total** | **106.4** | **12.5** | **Total** | **60.4** | **8.0** |
| **Merrillville Conservancy District** | | | **Independence Hill Conservancy District** | | |
| **Diameter** | **Gravity Sewer** | **Force Main** | **Diameter** | **Gravity Sewer** | **Force Main** |
| <8 inches | 71.3 | 6.7 | <8 inches | 34.0 | 1.0 |
| 9 – 18 inches | 38.6 | 5.5 | 9 – 18 inches | 15.8 | 0.7 |
| 19 – 36 inches | 14.6 | 7.0 | 19 – 36 inches | 0.02 | 0 |
| > 36 inches | 6.5 | 0 | > 36 inches | 0 | 0 |
| **Total** | **131.0** | **19.2** | **Total** | **49.7** | **1.7** |

## 2.3.2 Pump Stations

GSD currently owns, operates and maintains 27 pump stations. **Figure 2-2** and **Table 2-3** shows the location and summarize the characteristics of the GSD pump stations, respectively. The stations located at 27th Avenue and Chase Street (#1), 15th Avenue and Clay Street (#5), and Marquette Park (#15) are the three major pump stations that convey flows from low elevations. **Table 2-3** also include two pump stations that have been abandoned (#25) or converted to gravity (#2). **Figure 2-1** shows the major pump stations in satellite communities.

**Table 2-3. Pump Stations and Associated Capacities**

| # | Station Name | Address | Number of Pumps and Size | Pump Type | Firm Capacity (GPM) | Total Capacity (GPM) |
|---|---|---|---|---|---|---|
| **Combined** | | | | | | |
| 1 | 27th & Chase (New) | 2719 Chase Street | 4 Pumps @ 15,000 GPM | VFD | 45,000 | 60,000 |
| 2 | 35th & Washington | 3521 Washington Street | n/a (converted to gravity) | | | |
| 3 | 54th & Tyler (New) | 1010 W. 54th Avenue | 3 Pumps @ 800 GPM | Constant Speed | 1,600 | 2,400 |
| 4 | 54th & Tyler (Old) | 1010 W. 54th Avenue | 2 Pumps @ 1,700 GPM | Constant Speed | 1,700 | 3,400 |
| 5 | 15th & Clay | 4600 E. 15th Place | 4 Pumps @ 6,600 GPM | Constant Speed | 19,800 | 26,400 |
| 6 | Forrest | 8245 Forrest Avenue | 2 Pumps @ 1,500 GPM | Constant Speed | 1,500 | 3,000 |
| 7 | Sunrise (Spencer Street) | 5th Ave and Spencer Street | 3 Pumps @ 282 GPM | Constant Speed | 564 | 846 |
| 8 | Anderson (Blaine) | 333 Blaine Street | 2 Pumps @ 50 GPM | Constant Speed | 50 | 100 |
| **Sanitary** | | | | | | |
| 9 | Hobart Street | 460-464 Hobart Street | 2 Pumps @ 100 GPM | Constant Speed | 100 | 200 |
| 10 | 25th & Calhoun | 5713 West 25th Avenue | 3 Pumps @ 1,800 GPM | Constant Speed | 3,600 | 5,400 |
| 11 | 25th & Bell | 6902 West 25th Avenue | 2 Pumps @ 400 GPM | Constant Speed | 400 | 800 |
| 12 | 27th & Calhoun | 2731 Calhoun Street | 3 Pumps @ 800 GPM | Constant Speed | 1,600 | 2,400 |
| 13 | 33rd & Burr | 33rd and Burr Street | 2 Pumps @ 500 GPM | Constant Speed | 500 | 1,000 |
| 14 | Marshalltown | 2387 Wisconsin Street | 3 Pumps @ 500 GPM | Constant Speed | 1,000 | 1,500 |
| 15 | Marquette Sanitary | 800 Montgomery Street | 1 Pump @ 250 GPM<br>1 Pump @ 500 GPM<br>1 Pump @ 750 GPM | Constant Speed | 750 | 1,500 |
| 16 | Marquette Beach | 7190 Oak Avenue | 2 Pumps @ 80 GPM | Constant Speed | 80 | 160 |
| 17 | Lakeshore Drive East | 9400 Lakeshore Dr. | 2 Pumps @ 500 GPM | Constant Speed | 500 | 1,000 |
| 18 | Lakeshore Drive West | 8900 Lakeshore Dr. | 2 Pumps @ 500 GPM | Constant Speed | 500 | 1,000 |
| 19 | US20 & Hwy 51 | US20 & Route 51 | 2 Pumps @ 282 GPM | Constant Speed | 282 | 564 |
| 20 | Lake Street | 860 N. Lake Street | 2 Pumps @ 282 GPM | Constant Speed | 282 | 564 |
| 21 | Airport | 6001 Airport Road | 2 Pumps @ 1,800 GPM | Constant Speed | 1,800 | 3,600 |
| **Storm** | | | | | | |
| 22 | 34th & Burr | 34th Ave & Burr Street | 4 Pumps @ 14,588 GPM | Constant Speed | 43,764 | 58,352 |
| 23 | 32nd & Grant | 32nd Ave & Lincoln Street | 2 Pumps @ 282 GPM | Constant Speed | 282 | 564 |
| 24 | 42nd & Johnson | 4229 Johnson Street | 4 Pumps @ 33,000 GPM | Constant Speed | 99,000 | 132,000 |
| 25 | 48th & Carolina | 4818 Carolina Street | n/a (abandoned) | | | |
| 26 | 2nd & Tennessee | 100 Tennessee Street | 3 Pumps @ 500 GPM | Constant Speed | 1,000 | 1,500 |
| 27 | Marquette Storm | 800 Montgomery Street | 4 Pumps @ 18,000 GPM | Constant Speed | 54,000 | 72,000 |
| 28 | 15th & Fulton | 7107 W. 15th Avenue | 2 Pump @ 400 GPM | Constant Speed | 400 | 800 |
| 29 | Connecticut Street | 33rd Avenue & Connecticut Street | 3 Pump @ 8,000 GPM | Constant Speed | 16,000 | 24,000 |

### 2.3.3 CSO Outfalls and Regulators

GSD's sewer system includes 11 combined sewer overflow regulator structures, as shown in **Figure 2-2**. Seven structures discharge to the Grand Calumet River during peak flow conditions and divert dry weather flow to a large interceptor (the "east-west interceptor") which drains to GSD's WWTP. The other four CSO structures discharge to the Little Calumet River during peak flow conditions.

Overflow weir inverts, weir length, dry weather flow connector size, gate dimensions, and pipe cross-section geometry were measured as part of the 2008 field survey and used to verify and update the geometry at the eleven regulator structures represented in the collection system model. **Table 2-4** lists model geometry for these structures.

Six structures have a second downstream weir on the overflow pipe at the Grand Calumet River (Alley 9 CSO, Chase CSO, Colfax CSO, Pierce CSO, Polk CSO, and Rhode Island CSO). Each of the downstream weirs is higher in elevation that the upstream weir in the regulator structure and is the control feature on overflows to the Grand Calumet River.

At the WWTP, GSD operates remote controlled gates in the east-west interceptor connectors at the seven regulator structures along the Grand Calumet River. During storms, operators can open/shut the gates to control flow to the WWTP.

Weir adjustments have been made at Bridge CSO, Chase CSO and Colfax CSO since the submission of the 2011 Collection System Model. The weir elevations presented in **Table 2-4** reflect the adjustments that were made). It should be noted that the river weir elevations were not adjusted.

## 2.4 Service Area Population

**Table 2-5** summarizes the population for each community within current service area. Service area population for 1990, 2000 and 2010 were computed by intersecting service areas with census block boundaries of respective years. Service area population for 1960, 1970 and 1980 were estimated by assuming the service area has same percent change in population over the years as the entire community.

**Table 2-4. Summary of CSO Outfall and Regulator Structures**

| NPDES Outfall Number | Outfall Location | Weir (ft) | | | | Orifice Size (ft) | River Weir Elevation (ft) | Gate Operation | Note |
|---|---|---|---|---|---|---|---|---|---|
| | | Length (ft) | Offset (ft)(1) | Pre-2008 Elevation (ft) | Post-2008 Elevation (ft) | | | | |
| | **West Branch Little Calumet River** | | | | | | | | |
| 004 | 15th Avenue and Elkhart Street | 6.3 | 3.05 | 586.0 | No Change | 4x4 | Flap Gate | No | |
| 005 | 32nd Avenue and Broadway West | 12 | 2.4 | 596.4 | No Change | None | None | No | |
| 013 | 25th Avenue and Louisiana Street | 16 | 3.58 | 590.6 | No Change | None | None | No | |
| 015 | 32nd Broadway and Alley 1 East | 15 | 4.8 | 596.5 | No Change | None | None | No | Concrete weir at 591.5 ft(2) |
| | **East Branch Grand Calumet River** | | | | | | | | |
| 006 | Rhode Island at East Interceptor | 9 | 4.5 | 580.9 | No Change | 4x4 | 588.1 | Yes | Concrete river weir at 585.2 ft(2) |
| 007 | Alley 9 at East Interceptor | 16 | 3 | 581.9 | No Change | 5x3 | 589.5 | Yes | Concrete river weir at 586.7 ft(2) |
| 008 | Polk Street at East Interceptor | 5 | 2.2 | 585.1 | No Change | 1x1 | 585.5 | Yes | |
| 009 | Pierce Street at East Interceptor | 4x6 Gates | 1.19 | 580.1 | No Change | 4x4 | 585.5 | Yes | First weir is 3 flap gates each 4 ft x 6 ft |
| 010 | Bridge Street at East Interceptor | 15 | 7.1 | 584.6 | 585.71 | 3x3 | None | Yes | Concrete weir at 582.9 ft(2) |
| 011 | Chase Street at East Interceptor | 13 | 1.5 | 578.1 | 586.1 | 7x3 | 586.17 | Yes | Concrete river weir at 583.67 ft(2) |
| 012 | Colfax Street at West Interceptor | 13.6 | 6.95 | 583.6 | 585.35 | 3x3 | 583.8 | Yes | Concrete weir at 583.08 ft(2) Broken area of river weir low at 582.9 ft(2) |

**Notes:**
(1) Weir offset refers to the local height of the weir relative to the invert of the regulator structure.
(2) Several weir structures include in their weir elevation iron stop logs. For these locations the top elevation of the "concrete weir" on which the stop logs are stacked is provided.
(3) CSO 014 - 25th Avenue and Wisconsin Street - is filled with concrete and not included in the table. It is located upstream of a pump station in Gary's Marshal Town subdivision. During an Army Corp levee project, the levee raised the water level to the point where water was backflowing into CSO 014 and flooding the upstream neighborhood. To prevent that from happening, GSD closed the CSO with concrete. However, GSD does not want to remove the CSO from its NDPES permit because that would require significant cost, effort, and coordination with the Army Corps. Additionally, GSD would like to retain CSO 014 as a permitted CSO outfall in case of emergency. During the 12/19/2018 call with USEPA, IDEM, and DOJ, it was agreed upon that CSO 014 will remain in GSD's NPDES permit for now and it will be evaluated as part of the alternatives analysis.

**Table 2-5. Service Area Population**

| Community | Population | | | | | |
|---|---|---|---|---|---|---|
| | 1960* | 1970* | 1980 | 1990 | 2000 | 2010 |
| Gary | 178,320 | 175,415 | 151,968 | 116,646 | 102,746 | 80,294 |
| Hobart (satellite) | | | 22,987 | 21,822 | 25,363 | 29,059 |
| Lake Station (satellite) | | | 13,505 | 12,422 | 12,622 | 11,849 |
| Merrillville (satellite) | | | 26,366 | 25,966 | 28,498 | 32,725 |
| New Chicago (satellite of Lake Station) | | | 2,581 | 2,066 | 2,063 | 2,035 |
| Wheeler and Duck Creek subdivision (satellite of Hobart) | | | 250 | 240 | 350 | 620 |

* GSD starts serving satellite communities in the 1980s

## 2.5 Wastewater Treatment Plant

GSD's WWTP is located at 3600 West Third Avenue. **Figure 2-4** shows the site plan for the existing WWTP, which was originally designed and operated as a two-stage activated sludge plant, with a design average flow of 60 million gallons per day (MGD), and a design peak wet weather flow of 120 MGD. In the mid-1990s, the plant was modified to a single-stage activated sludge plant and the aeration system was converted from coarse to fine bubble diffusion.

The GSD WWTP plant consists of the following facilities and infrastructure:

- Preliminary Treatment (screening, grit removal and pumping)
- Primary Treatment (primary clarification)
- Secondary Treatment (bioreactors (aeration tanks) and secondary clarification)
- Tertiary Treatment (sand filtration)
- Disinfection (chlorination and de-chlorination)
- Yard Piping and Conduits
- Solids Handling Systems

Plant influent passes first through the headworks that consist of a single trash rack followed by mechanical screening and grit removal. From grit removal the wastewater is then pumped to the primary clarifiers for removal of settleable solids and particulate biochemical oxygen demand (BOD). Primary sludge is de-gritted and pumped to gravity thickening prior to stabilization via anaerobic digestion. Primary effluent is then distributed to bioreactors consisting of anaerobic and aerobic zones (A/O process configuration) for the removal of particulate BOD, soluble BOD, ammonia and phosphorus. There are six bioreactors; the first 1/3$^{rd}$ of the first pass of each bioreactor is operated anaerobically, while the remainder of each bioreactor is operated aerobically. Mixed liquor from the aeration tanks is distributed to the secondary clarifiers. Secondary effluent is then conveyed to the filter influent pumps and tertiary filtration. Once filtered, effluent is chlorinated and de-chlorinated with sodium hypochlorite and sodium bisulfite, respectively. Post aeration is provided (via blowers) prior to final discharge to the East Branch of the Grand Calumet River. The final effluent is discharged from the chlorine contact tanks through parallel outfalls 001A and 001B.

Solids settled out in the primary and secondary clarifiers are thickened using gravity thickening tanks and gravity belt thickeners, respectively. Once thickened the sludge is blended prior to transfer to anaerobic digesters for solids stabilization. Once digested, bio-solids are dewatered using belt filter presses and the final product is hauled to a nearby landfill for ultimate disposal.

Detailed information about the WWTP's current flows and loads, design criteria, unit process analysis and figures displaying the current process flow can be found in the Stress Test Report.

### 2.5.1 Dry Weather Operation

During dry weather operation the GSD WWTP facility is operated will all unit processes treating the entirety of the flow. During dry weather periods, the GSD WWTP staff continually monitors the process and adjusts operating parameters for process optimization. Process optimization efforts are typically conducted to improve performance while reducing operating costs, for exampling reducing chemical or energy consumption. Typically, at minimum two blowers are operating during peak loading conditions (typically day-time) and one blower is operating during lower loading periods (typically overnight). Return activated sludge (RAS) pumps are controlled between 60 to 80% of the influent flow.

### 2.5.2 Wet Weather Operation

During wet weather flow conditions, the GSD WWTP facility is operating with all unit processes online, and, when applicable, each unit process will treat the maximum peak treatable flow for that unit process. Based on design criteria and current operating conditions each treatment unit process has been rated for a maximum peak treatable flow (discussed in detail in the Stress Test Report and summarized in **Section 2.5.3**), however, it is important to note that typically that the GSD WWTP staff will push unit processes past their design firm capacities, when hydraulically possible, to avoid CSO activation and despite the operational difficulty associated with these events. During wet weather events, the operations staff must maintain minute by minute vigilance over the treatment process to ensure maximum flow treatment without compromising effluent quality. The secondary treatment process (bioreactors and secondary clarifiers) are able to treat a maximum daily flow of 142 MGD, based on operational set points, influent loading conditions and the results of stressing the system. Limitations in the solids handling process (i.e. waste activated sludge system as discussed in the stress test report) often make processing difficult. During wet weather flow conditions, the treatment plant staff make adjustments to RAS pumping rates, solids wasting rates, chemical feed dosing, and blower operation to manage the maximum amount of flow possible without compromising effluent quality. This has allowed the WWTP to treat flows up to 142 MGD on a maximum day basis as well as slightly higher peak hour flows.

During wet weather conditions, there are hydraulic limitations in the system that cause bypasses. For example, the tertiary filter pumps are rated for a firm capacity of approximately 130 MGD, so flows over 130 MGD may bypass the tertiary filters. On the other hand, processes like the trash rack, fine screens and the grit tanks receive flows over their firm capacity design flows and the GSD WWTP staff are able to maintain adequate performance.

Gates effecting flow to the WWTP are not being throttled to reduce flow to the plant under the maximum peak treatable flow capacity of the secondary treatment process (142 MGD). The raw influent pumps are operated to maintain this maximum day flow set-point and have a firm capacity of 150 MGD.

### 2.5.3 WWTP System Deficiencies and Unit Process Maximum Peak Treatable Flow Capacity

**Table 2-6** shows the maximum peak treatable flow for each WWTP unit process. The WWTP staff have shown that they are able to treat flow higher than design firm capacity of particular units without degrading plant effluent quality; however, operating in this mode does have longer term implications, for example, more frequency equipment maintenance requirements. Currently, the tertiary filers are bypassed during flows above 130 MGD (firm capacity of tertiary pumps). The flow bypassed around the tertiary filter is blended with the tertiary effluent and has consistently met permit requirements under recent flow and loading conditions. If higher flows (i.e. above 142 MGD maximum day) are to be treated, the efficacy of continuing to bypass the tertiary process at flows above 130 MGD needs to be examined. Ultimately with more pumping capacity the tertiary filtration system could handle flows up to 160 MGD (firm capacity).

Maximum day peak treatable flow is currently capped at 142 MGD due to the limitations of the secondary treatment process. To increase wet-weather flow capacity modifications to both the secondary treatment process and the solids handling process will be required to increase the maximum peak treatable flow of the system. Additionally, further examination is required to assess the cost-benefit of improving other unit processes so that their design firm capacities match that of the desire influent maximum day peak treatable.

**Table 2-6. Maximum Peak Treatable Flows of Each WWTP Unit Process**

| Unit Process | Current Maximum Peak Treatable Flow | Number of Units | Basis |
|---|---|---|---|
| Trash Rack | 142 MGD | 1 Duty | WEF MOP 8 recommends velocity of 3 ft/sec at maximum flows, which would rate the screen at a 100 MGD firm capacity; however, based on system performance flows up to 142 MGD are acceptable. |
| Fine Screens | 142 MGD | 3 Duty (1 Standby) | Based on a WEF MOP 8 the recommended approach velocity of 3 ft/sec rates the firm capacity at 133 MGD with one unit out of service. The plant has stressed these screens up to 142 MGD without degrading performance. |
| Grit Tanks | 150 MGD | 2 Duty | Standard Design for detritus tanks (grit tanks) as detailed in Metcalf and Eddy (1999) is based on grit removal of at least 95% removal of 100 mesh grit. With this design condition the grit tanks are rated for a firm capacity of 104 MGD. At a peak hour flow of 150 MGD, the system is expected to removal 95% of grit greater than 70 mesh, which is acceptable for a maximum day condition. The system has only been stressed up to 142 MGD. |

| Unit Process | Current Maximum Peak Treatable Flow | Number of Units | Basis |
|---|---|---|---|
| Influent Pumps | 150 MGD | 5 Duty (2 Standby) | The influent pumps firm capacity of 150 assumes that each wet well has a redundant (standby) pump. Potentially the option to reduce the number of standby pumps could be explored in the future, but due to the current limitations of the secondary treatment process 142 MGD should be considered the maximum day peak treatable flow for the GSD WWTP based on raw influent flow. |
| Primary Clarifiers | 150 MGD | 8 Duty Squircle<br>2 Duty Rectangular | Based on a Ten States Standards peak surface overflow rate (SOR) of 2,000 gpd/sf, achieved at an influent flow of 150 MGD. Although retrofitted (i.e. clarifier baffles) could maintain adequate performance of the clarifiers at higher flows, further discussions regarding surpassing Ten States Standards are required. |
| Bioreactors (Aeration Tanks) | 142 MGD | 2 Duty – 4 Pass<br>4 Duty – 3 Pass<br>20 MG (Total) | Based on the current loading rates and required level of treatment the current volume is adequate when operated at a minimum SRT of 12 days and MLSS of 3,800 mg/L. Capacity of a secondary treatment process is highly dependent on influent conditions, operational flexibility and treatment process configuration. The maximum peak treatable flow is determined by the secondary clarifier capacity. |
| Secondary Clarifiers | 142 MGD | 16 Duty Squircle<br>8 Duty Circular | Based on solids flux using a state point analysis with the current operating conditions (i.e. MLSS concentration of 3,800 mg/L and SVI of 125 mL/g) the current maximum day secondary clarifier capacity is 142 MGD (based on raw influent flow). State point is the recommended method to determine secondary clarifier capacity and well documented in WEF MOP 8. Using this analysis, a maximum peak treatable flow rating is developed for the maximum day condition. |
| Filter Influent Pumps | 130 MGD | 4 Duty (1 Standby) | Currently the filter system is still in a start-up mode with three pumps online. Once fully operational the expected capacity with 4 duty pumps is 130 MGD for the pumping system. (Note: due to filter modifications necessary during mid-construction the weir elevations are not consistent with the original filter design and may decrease the capacity of the screw pumps that is hydraulically possible). With 9 filters in service the maximum pumping capacity correlates to hydraulic loading rate of 4.7 gpm/sqft. |
| Effluent Filters | 160 MGD | 9 Duty (1 Standby) | WEF MOP 8 states that typical sand filtration should have a maximum hydraulic loading rate of 6.0 gpm/sqft, which is achieved at 160 MGD at the GSD WWTP with 9 filters in service. It should be noted that currently the pumping system is unable to deliver 160 MGD to the filters. |
| Chlorine Contact Tanks | 224 MGD | 5 Duty | WEF MOP 11 and Ten States Standards require states peak flow chlorine contact basin detention time should be at minimum 15 minutes during peak flows, which is achieved at 224 MGD at the GSD WWTP. |

A detailed analysis of unit WWTP unit processes including full plant hydraulic analysis is included in the Stress Test report.

## 2.6 Flow Statistics

GSD records peak hourly and average daily flow at the WWTP, and average daily flow for its satellite communities at each connection. **Table 2-7** summarizes the annual average flows of WWTP and each connection to GSD's collection system.

**Table 2-7. Annual Average Flows (MGD)**

| Year | WWTP | Hobart | Lake Station (35th & Florida) | Lake Station (15th & Clay) | Merrillville (48th & Alley One) | Merrillville (35th & Chase) |
|---|---|---|---|---|---|---|
| 2013 | 44 | 3.1 | 0.19 | 1.6 | 1.8 | 2.9 |
| 2014 | 53 | 4.1 | 0.23 | 1.8 | 2.2 | 3.4 |
| 2015 | 47 | 3.7 | 0.21 | 1.6 | 2.1 | 3.1 |
| 2016 | 50 | 3.9 | 0.22 | 1.6 | 2.3 | 3.3 |
| 2017 | 48 | 3.6 | 0.21 | 1.5 | 2.3 | 2.9 |

## 2.7 Significant Industrial Users

GSD has identified 14 SIUs in its service area, which are summarized in **Table 2-8**. **Figure 2-3** presents the location of the SIUs relative to the downstream overflow location. None of the SIUs are identified as a categorical industrial user.

Of note:

- Beaver Oil Company was disconnected from GSD's sewer system since October 2005 due to multiple violations.
- Stericycle's major industrial process is steam sterilization and does not involve chemicals. Stericycle submits to GSD monthly self-monitoring reports, and has reported two exceedances in mercury (April 2018: 0.0010 ppm and July 2018: 0.0011 ppm) in the last three years.
- US Steel possesses its own NPDES permits for various industrial processes. US Steel only conveys sanitary sewage and boiler water discharge (small flow at Broadway lift station) to GSD. During a process upgrade project, US Steel was permitted to temporarily discharge leachate at the Broadway lift station. In the past six years (2013-2018), US Steel has exceeded mercury (above local limit of 0.0009 ppm) twice at the Broadway lift station (October 2016) and once at the Buchanan lift station (April 2013).

GSD is discussing with its SIUs as part of its pretreatment program implementation of nine minimum controls.

**Table 2-8. Significant Industrial Users**

| Significant Industrial User | SIC Code | Address | 2017 Flow | | CSO Tributary | Categorical Industrial User | Pollutants of Concern |
|---|---|---|---|---|---|---|---|
| | | | Daily Avg (MGD) | Annual (MG) | | | |
| Beaver Oil Company | 5172 | 1040 Michigan St. Gary, Indiana 46402 | Disconnected, October 2005 | | | | |
| Buffington Harbor Casino | 7011 | 1 Buffington Harbor Gary, Indiana 46406 | 0.07 | 24,988 | No (Direct to WWTP | No | Not Applicable |
| Chicago Steel | 1791 | 700 Chase Street Gary, Indiana 46404 | 0.03 | 9.6 | Chase | No | Not Applicable |
| Gary Sanitary Landfill | 4953 | 1900 Burr St. Gary, IN 46406 | 0.14 | 50 | Colfax | No | Not Applicable |
| Indiana-American Water Company | 4941 | 650 Madison Street Gary, Indiana 46402 | 0.02 | 8.9 | Pierce | No | Not Applicable |
| Lake Shore Trucking | 7538 | 2250 East 15th Avenue Gary, Indiana 46402 | 0.008 | 2.8 | Rhode Island | No | Not Applicable |
| Loves Travel Center | 5541 | 3150 Grant Street Gary, Indiana 46408 | 0.02 | 7.0 | Chase | No | Not Applicable |
| Methodist Hospital - Northlake | 8062 | 600 Grant Street Gary, Indiana 46402 | 0.09 | 32 | Bridge | No | Not Applicable |
| Monosol | 2671 | 1701 County Line Rd. Portage, IN 46368 | 0.06 | 23 | Elkhart | No | Not Applicable |
| Petro #369 | 5541 | 3001 Grant Street Gary, IN 46408 | 0.03 | 9.7 | Chase | No | Not Applicable |
| Schneider National Trucking | 4213 | 7101 17th Avenue Gary, Indiana 46406 | 0.005 | 1.7 | Colfax | No | Not Applicable |
| Stericycle | 4953 | 1310 Michigan Street Gary, Indiana 46402 | 0.02 | 6.0 | Rhode Island | No | Hg, Zn |
| Travel Centers of America | 5541 | 2510 Burr Street Gary, Indiana 46406 | 0.01 | 3.5 | Chase | No | Not Applicable |
| USS Corporation | 3325 | 1 North Broadway Gary, Indiana 46402 | 1.3 | 477 | No (Direct to WWTP | No | Hg |

# Section 3

# Receiving Waters and Water Quality

This section provides information on the history, current regulatory status and water quality of the rivers to which the GSD CSOs discharge. These rivers are designated as receiving waters. In addition to the receiving waters, water quality is evaluated for downstream waterbodies, since these waters may be impacted by pollutants discharged upstream.  Understanding the water quality of these receiving waters provides a baseline for evaluating impacts of improvements in the water quality due to reductions in CSOs. The regulatory status and water quality is used to identify the pollutants of concern (POCs).

The receiving waters for the GSD CSOs include the Little Calumet River and the Grand Calumet River, shown on **Figure 3-1**. Both these waterbodies flow into Lake Michigan. Descriptions and general information, including summaries of relevant previous projects which impact water quality or hydrology, are summarized for each of the receiving waters. Applicable water quality standards are reviewed. The current designations from 305b/303d listing and total maximum daily load (TMDL) status and development are discussed to provide the background on regulatory goals for each receiving water.

Water quality data has been collected by many entities including the Gary Sanitary District, IDEM and others. This data is summarized and water quality parameters related to CSOs and aquatic health are presented along the Little Calumet River, Grand Calumet River and Lake Michigan shoreline. This data summary includes analysis of observed concentrations and daily discharge in the rivers to assess the relationship of the hydrologic flow condition and water quality. The section ends with a discussion of the pollutants of concern in the waterways.

Existing and potential recreation in and near the waterways is discussed in **Section 4** as part of the analysis of Sensitive Areas and beneficial uses.

## 3.1 Receiving Water Descriptions

For the purposes of the CSO Characterization Report, data was collected and reviewed for the area defined by the Little Calumet River and Grand Calumet River within Indiana and their contributing tributaries and watersheds and Lake Michigan extending 1.5 miles from the shoreline and running from Calumet Park west of the Indiana Harbor to Trail Creek in the east and contributing shoreline in this area. The U. S. Geological Survey (USGS) hydrologic cataloging units (HUC) for the study area is shown in **Table 3-1** and on **Figure 3-1**. The study area includes portions of the Little Calumet-Galien hydrologic cataloging unit (HUC 0404 0001) in the Southwestern Lake Michigan basin, the Chicago River (HUC 0712 0003) in the Upper Illinois basin and Lake Michigan (HUC 0406 0200).

The study area lies at the southern tip of Lake Michigan in the Calumet lacustrine plain and the Valparaiso terminal moraine, which were created by glacial activity approximately 18,000 years ago (Nevers et al. 2000). The Valparaiso terminal moraine is the historic drainage divide for the Lake Michigan and the Mississippi River drainage areas. Large areas, particularly along the Lake Michigan shoreline, have been developed for industrial purposes such as steel manufacturing. The natural flow pathways for local rivers have been extensively channelized and modified. The area contains unique dune and swale habitat. Today efforts are on-going to address historical pollution from industrial and other anthropogenic sources. These efforts have improved water quality and restored some natural habitat. This report summarizes key efforts and identifies current and potential beneficial uses for drinking water consumption, recreation and aquatic habitat for the study area.

Presently the Grand Calumet River within the study area discharges to Lake Michigan. Most of the Little Calumet River discharges to Lake Michigan via the Portage-Burns Waterway and Burns Ditch. There is an East-West flow divide in the Little Calumet River, located near Grant Street in Gary, Indiana. Depending on hydrologic conditions the river in this area can discharge to the Portage-Burns Waterway in the east or the river can flow west towards Illinois and ultimately into the Mississippi River. The Little Calumet River Flood Control and Recreation project (USACE 2018) will provide a 200-year level of flood protection and improve recreational access. The flood control will change the hydrology of the system by retaining flood waters in the Little Calumet River between Northcote Avenue in Hammond, Indiana and the Deep River. A flow structure near Northcote Avenue, limits high flows in the Little Calumet River to the west.

**Table 3-1. HUC 12 Watershed in Study Area**

| Waterbody | Watershed Name | HUC12 ID | Watershed Size (sq. mi.) |
|---|---|---|---|
| Little Calumet River | Town of Black Oak – Little Calumet River | 0712 0003 0305 | 25.6 |
| | Little Calumet River – Deep River | 0404 0001 0508 | 19.0 |
| | Willow Creek-Burns Ditch | 0404 0001 0509 | 21.1 |
| Grand Calumet River | Headwaters Grand Calumet River | 0712 0003 0406 | 24.1 |
| Lake Michigan | Calumet River – Frontal Lake Michigan | 0404 0001 0603 | 54.0 |
| | Lake Michigan | 0406 0200 0000 | |

## 3.1.1 Little Calumet River

The Little Calumet River watersheds in the study area encompass an area of 65.7 square miles in Lake and Porter Counties in northern Indiana. The river flows through the towns of Munster, Hammond, Highland, Gary, Griffith, Lake Station, and Portage, Indiana. Prior to the 1920s the river flowed west and south and discharged to the Calumet River in Illinois. The Burns Ditch was constructed in the 1920s to connect the Little Calumet River to Lake Michigan, and effectively reversed the flow of the river.

The Little Calumet River in the study area runs for 11. 4 miles between Hart Ditch and the confluence of the Little Calumet River with the Deep River located in Lake Station Indiana and 8. 2 miles from Deep River to Lake Michigan. West of the Deep River, the Little Calumet River is surrounded by marshes and flood plains. The area is part of the Little Calumet River Flood Control Project and provides recreation, ecological habitat and flood control. GSD CSO outfalls 005, 015, and 013 are located in this stretch of the river. Flow rates are limited at high flows by numerous culverts. East of the confluence with the Deep River to Lake Michigan, the Little Calumet River is channelized and generally surrounded by agricultural, forested and developed land. One GSD CSO outfall, 004, discharges in this stretch of the river.

The East Arm of the Little Calumet River joins the Little Calumet River just before the river flows northward through the Burns Ditch into Lake Michigan. Major tributaries include the Deep River and Willow Creek to the Little Calumet River and Salt Creek to the East Arm of the Little Calumet River. The Little Calumet River also flows west depending on hydrologic conditions. This flow divide exists west of Grant Street in Gary, Indiana. Flow direction in the Little Calumet River west of Grant Street is generally towards the Calumet-Sag Channel and Calumet River in Illinois. During period of high flows, flow in this area may go east towards Burns Ditch and into Lake Michigan.

#### 3.1.1.1 Little Calumet River Flood Control Project

The Little Calumet River Flood Control and Recreation project, managed by the Army Corps of Engineers (USACE), includes flood control and recreation benefits along the Little Calumet River in Northwest Indiana (USACE 2018). This project will provide a 200-year level of flood protection by of replacing and expanding the existing 22 miles of levees and floodwalls, rehabilitation of existing pump stations, a flow control structure, nonstructural flood proofing, and a flood warning system for flood damage reduction and recreation features. It also includes the installation of a control structure at Hart Ditch near Northcote Avenue, building almost 17 miles of hiking trails and preserving over 550 acres of wetland. The project involves relocating 7 miles of river channel to allow better water flow, modifying highway bridges to permit unobstructed flow of water and installing a flood warning system. This project will protect more than 9,500 homes and businesses in Gary, Griffith, Hammond, Highland and Munster. This project started construction in 1990, and the flood protection features were completed in 2017. The entire project will be complete by 2024, and currently is around 90% complete.

#### 3.1.1.2 Little Calumet River TMDLs

Two TMDLs have been developed to address water quality in the Little Calumet River.

The Little Calumet and Portage Burns Waterway TMDL for *E. coli* bacteria (Earth Tech 2004) addresses *E. coli* impairment on 30 miles of the Little Calumet – Portage Burns Waterway including the East Arm of the Little Calumet River and the Portage Burns Ditch west to the Deep River. The TMDL will require over 90% of nonpoint source loads including loads to upstream tributaries.

The Draft TMDL Report for the Deep River-Portage Burns watershed (IDEM 2014) includes a portion of the Little Calumet River, the Deep River and upstream tributaries. The report establishes TMDLs to address *E. coli,* phosphorus, dissolved oxygen, impaired biotic communities and siltation. Potential sources for the impairments include point and non-point sources.

### 3.1.2 Grand Calumet River

The Grand Calumet River watershed for the East Branch of the river is 24.1 square miles in Lake County in northern Indiana. The river flows through the towns of East Chicago, Hammond, and Gary, Indiana. The Grand Calumet River flows 9.9 miles from the headwaters through developed areas and natural and reclaimed areas to the Indiana Harbor Canal and then discharges to Lake Michigan through the Indiana Harbor Canal. Developed areas include industrial areas, in particular the US Steel Plant. Stretches also include commercial and residential properties. The US Steel Plant has numerous permitted discharges along the Grand Calumet River. The Gary Sanitary District

WWTP and CSO Outfalls 012, 011, 010, 009, 008, 007 and 006 discharge to the Grand Calumet River in the study area. The Indiana Harbor Canal is surrounded by industrial areas and supports commercial ship traffic.

The Grand Calumet River and Indiana Harbor Canal were identified as part of the Great Lakes Water Quality Agreement of 1978 as an Area of Concern (AOC) based on identified water quality impairments. As part of the Agreement, Stage 1 and Stage 2 Remedial Action Plans have been developed by the USEPA and submitted to the International Join Commission (USACE 2004). The U.S.-Canada Great Lakes Water Quality Agreement (Annex 2 of the 1987 Protocol) defines AOCs as "geographic areas that fail to meet the general or specific objectives of the agreement where such failure has caused or is likely to cause impairment of beneficial use of the area's ability to support aquatic life." Activities in the Grand Calumet River AOC have included in-stream restoration, dredging and remediation of sediment, deep pool restoration, and restoration of marginal wetlands (USEPA 6/21/2018b).

#### 3.1.2.1 Grand Calumet River TMDL

The USACE completed a TMDL Study for the Grand Calumet River and Indiana Harbor Canal Watershed on behalf of IDEM in 2004 (USACE 2004). The study looks at water quality for a section of the Grand Calumet River in Gary (East Branch) and the Grand Calumet River west of the Indian Harbor Canal (West Branch) in addition to the Indiana Harbor Canal. TMDL recommendations were developed for chloride, ammonia, cyanide, oil & grease, mercury and PCBs/pesticides.

The following TMDL recommendations were developed:

- Reduce effluent concentrations of chloride for the Hammond Sanitary District outfall (West Branch)
- Monitor potential sources of free cyanide to ensure NPDES permit discharge standards are achieved
- Sediment cleanup to remove source of oil & grease, PCB and free cyanide contamination
- Mercury will be addressed separately

### 3.1.3 Lake Michigan

Lake Michigan is not a direct receiving water for the GSD CSOs but is included because it is downstream of the Grand Calumet River and Little Calumet River. Lake Michigan is the third largest Great Lake by surface area and the sixth largest freshwater lake in the world. Four states (Wisconsin, Illinois, Indiana, and Michigan) share the 1,638 miles of shoreline. There are 45 miles of shoreline within the State of Indiana (Tetra Tech 2004).

The area of study includes Lake Michigan extending 1. 5 miles from the shoreline and running from Calumet Park west of the Indiana Ship Canal to the Trail Creek in the east. The shoreline includes parts of the Chicago in Illinois, and Hammond, Whiting, East Chicago, Gary, Portage, Ogden Dunes, Burns Harbor, Dune Acres, Porter, Beverly Shores, and Michigan City in Indiana. The Lake Michigan shoreline in the study area includes multiple municipal beaches as well as the Indiana Dunes National Lakeshore. This park includes approximately 25 miles of beach shoreline and is an important national recreation area.

Long-term currents in Lake Michigan are cyclonic (rotate counterclockwise) and average 1.9 cm/s (Beletsky et al. 1999). Circulation increases in the winter and is lower in the summer. Currents on the east coast are stronger than on the west coast of the lake. The increase in winter circulation strength corresponds to an increase in wind stresses.

Seiche effects are typically caused by strong winds and rapid changes in atmospheric pressure. In Lake Michigan, the 300 miles from one end to the other allows large waves to develop. The water oscillates back and forth, similar to water sloshing back and forth in a bathtub. The oscillation can last several hours or days (NOAA 2018).

The Lake Michigan lake bed slopes gently off the Illinois shoreline. Off the Indiana shoreline east of Gary a steep nearshore ramp has developed (i.e. water increases from 0 to 15 meters within 1 kilometer of shore. The Indiana Shoals, located north of Indiana Harbor, are a set of north-northeast trending ridges on the lake bottom. These ridges are as high as 3 meters and spaced 100 to 300 meters apart.

Sediments vary on the lake bed and offshore sediment is highly mobile. Sand is not abundant throughout much of the lake bottom. Layers of sand are 0.5 to 1 m thick and appear to be mobile and move depending on waves from storms and on currents. Generally, from offshore to nearshore, lacustrine mud is present and then patchy sandy silt to silty sand to modern beach sands nearshore. Net transport of sand is south toward the Indiana Dunes area, where it is left on the beaches and moved to the dunes by onshore wind transport. (Foster and Folger 1994)

#### 3.1.3.1 Indiana Dunes National Lakeshore

Nearly 25 miles of Lake Michigan shoreline between Michigan City in the east and Gary in the west was designated as the Indiana Dunes National Lakeshore in 1966. This 15,000-acre park is part of the National Park System. The National Lakeshore also includes the Indiana Dunes State Park, which includes over 2,000 acres owned by the state of Indiana. The park includes several natural areas and preserves, historic sites, beaches, camping areas and trails. Additional information on the park can be found at https://www.nps.gov/indu/index.htm.

#### 3.1.3.2 Lake Michigan TMDL

The Lake Michigan Shoreline TMDL for *E. coli* Bacteria (Tetra Tech 2004) addresses *E. coli* impairment along the Lake Michigan Indiana shore. The TMDL load allocations assume that all concentrations in tributaries are a maximum of 125 cfu/100mL.

## 3.2 Applicable Water Quality Standards

The area study area includes portions of Lake Michigan and waters within the states of Indiana and Illinois. The water quality standards for both states are summarized below. While the state water quality standards cover a wide variety of substances, the summary below focuses on *E. coli* bacteria as the primary pollutant of concern from the combined sewer overflow discharges.

Waters in the Lake Michigan watershed are subject to the Great Lakes Water Quality Agreement between the United States and Canada. This agreement was first signed in 1972 and has been updated in 1983, 1987 and most recently in 2012. The document is intended to restore and protect the water quality and ecology of the Great Lakes. The water quality regulations of Indiana and Illinois, discussed below, reflect this agreement.

## 3.2.1 Indiana State Water Quality Standards

Indiana water quality standards are described in Title 327 of the Indiana Administrative Code (Ind. AC) with specific rules and standards for waters within the Great Lakes system found in Article 2 (327 Ind. AC 2-1.5).

### 3.2.1.1 Great Lakes system

The Great Lakes system is defined as all streams, rivers, lakes, and other waters of the state within the drainage basin of the Great Lakes within Indiana. This includes the portions of the Little Calumet River and tributaries including the Deep River and East Arm of the Little Calumet River, the lakeshore along Lake Michigan and the Indiana Harbor Canal. The HUC designations for the Little Calumet River east of Hart Ditch and the Grand Calumet River categorize these watersheds as part of the Upper Mississippi region, but since flow directions are predominately towards Lake Michigan under current hydrologic conditions, these rivers should be considered part of the Great Lakes System.

As stated in Title 327 Article 2 Rule 1.5 Water Quality Standards Applicable to All State Waters Within the Great Lakes System, "the goal of the state is to restore and maintain the chemical, physical and biological integrity of the water of the state within the Great Lakes system." All surface waters in the Great Lakes system are designated for full-body contact recreation and should be capable of supporting a well-balanced, warm water aquatic community.

There are several water intakes for public water supply and industrial uses on Lake Michigan described in **Section 4.2** of this report. Therefore, Lake Michigan is also designated as a public water supply and as an industrial water supply. For waters with multiple designations, the most stringent water quality standards criteria apply.

### 3.2.1.2 Salmonid waters

Specific waters have been designated as "salmonid waters" as listed in 327 Ind. AC 2-1.5-5. Rivers and waterbodies within the area of interest include the East Arm of the Little Calumet River and its tributaries downstream to Lake Michigan via Burns Ditch, Salt Creek above its confluence with the Little Calumet River, Trail Creek and its tributaries downstream to Lake Michigan, and the Indiana portion of the open waters of Lake Michigan. In addition, the Indiana portion of the open waters of Lake Michigan and waters in the Indiana Dunes National Lakeshore have been designated as an outstanding state resource water per 327 Ind. AC 2-1.5-19.

### 3.2.1.3 General Water Quality Standards

Regulations have been promulgated for many compounds including bio-accumulative chemicals (327 Ind. AC 2-1.5-6) including polychlorinated biphenyls (PCBs) and other substances which have been found in the sediments of the Grand Calumet River.

At a minimum surface water will be free from substances, materials, floating debris, oil, or scum of anthropogenic origin. Concentrations of any substances must be at a level protective of aquatic life, defined for specific chemicals. Dissolved oxygen must average at least 5 milligrams per liter per day (mg/L/day) with a minimum of 4 mg/L/day at any time. Water temperatures should follow the daily and seasonal temperature fluctuations of natural waters. Maximum instream water temperatures are defined in the standards.

#### 3.2.1.4 *E. coli* Bacteria Standards for recreation

Title 327 Ind. AC 2-1.5-8.e defines *E. coli* bacteria standards to support high quality waters for full body, or primary, contact recreation (i.e. swimming). The recreation season is defined as April 1 through October 31. During this period, the geometric mean of *E. coli* should not exceed 125 colony forming units per 100 milliliters (cfu/100mL). The geometric mean should be calculated with five or more samples equally spaced over a 30-day period. In addition, *E. coli* bacteria should not exceed 235 cfu/100mL in any one sample if less than 10 samples are collected in a 30 day period. *E. coli* bacteria should not exceed 235 cfu/100mL in 90% of the samples if 10 or more samples are collected in a 30 day period, provided that the *E. coli* is the result of a discharge from treated wastewater and the geometric mean criteria is met. For beach closures, *E. coli* bacteria results from single samples are used.

#### 3.2.1.5 CSO Wet Weather limited use designations

The CSO wet weather limited use designation has been established as a subcategory of the recreational use designation as described in 327 Ind. AC 2-1-3.1. To obtain this designation, a CSO community must follow several steps including submission of a use attainability analysis (UAA) and a long term control plan (LTCP). Discharge limitations, as determined in the LTCP, are incorporated into the NPDES discharge permit. This designation, if approved, is in effect from the start of the combined sewer overflow discharge event and for up to 4 days after the discharge ends.

#### 3.2.1.6 Site-specific water quality criteria for the GCR

Site-specific water quality criteria for cyanide have been established for the East Branch of the Grand Calumet River starting at U. S. Steel outfall 005 and ending 1 mile downstream (327 Ind. AC 2-1.5-16). These site-specific water quality criteria set the criterion maximum concentration (CMC) and 4-day average continuous criterion concentrations (CCC) for free cyanide.

### 3.2.2 Illinois Water Quality Standards

The primary receiving waters for the GSD CSOs are in the State of Indiana. However, a portion of Lake Michigan within Illinois extending from the state boundary west to Calumet Park is also included. In addition, in certain hydrologic conditions, the Little Calumet River and Grand Calumet River can flow west. Therefore, a brief summary of Illinois water quality standards is included.

Illinois water quality standards are promulgated by the Illinois Pollution Control Board and are found in Title 35 of the Illinois Administrative Code (Ill. AC) Section 302 Water Quality Standards and Section 303 Water Use Designations and Site-Specific Water Quality Standards.

Specific standards have been developed for the Lake Michigan basin and for the Chicago Area Waterway system. The Little Calumet River and the Grand Calumet River in Illinois are considered part of the Chicago Area Waterway system.

#### 3.2.2.1 Fecal Coliform

Bacteria water quality standards for Illinois are specified for fecal coliform in 35 Ill. AC 302.209. Fecal coliform is composed of several species of bacteria and serve as an indicator of possible sewage contamination. *E. coli* is a single species within the fecal coliform group. For Illinois, the recreation season is defined as May 1 through October 31, one month shorter than the recreation season in Indiana. During the recreation period, the geometric mean of a minimum of 5 samples collected over not more than a 30 day period should not exceed 200 cfu/100 mL. Ninety percent of the samples need to be less than 400 cfu/100 mL. This standard applies to protected waters which are defined as primary contact recreation waters or waters that flows through or adjacent to parks or residential areas.

#### 3.2.2.2 Chicago Area Waterways

Most of Chicago Area Waterway system, including the Little Calumet River, is designated for primary contact recreation use and for high quality aquatic life. Fecal coliform bacteria standards described above apply to these waters.

The Grand Calumet River within Illinois is designated as incidental contact recreation waters per 35 Ill. AC 303.225. Incidental contact recreation covers activities such as fishing, commercial and small recreational boats and shoreline activity such as wading defined in 35 Ill. AC 301.282.

#### 3.2.2.3 Lake Michigan Basin

Specific standards for the Lake Michigan basin with Illinois are listed in Subpart E of 35 Ill. AC 302. These standards apply to the open water of Lake Michigan within the state of Illinois. The Calumet River in Illinois is not included as part of Lake Michigan basin. Fecal coliform standards for Lake Michigan are listed in 35 Ill. AC 302.505.

The geometric mean of a minimum of 5 samples collected over not more than a 30-day period should not exceed 20 cfu/100 mL in the open waters of Lake Michigan. Open waters of Lake Michigan include all water in the lake from a line drawn across of the mouth of the tributaries and lakeward. This does not include water enclosed by constructed breakwaters. For waters in tributaries and within breakwaters, the geometric mean of a minimum of 5 samples collected over not more than a 30-day period should not exceed 200 cfu/100 mL for fecal coliform. Ninety percent of the samples need to be less than 400 cfu/100 mL.

## 3.3 Stream Designations

The Clean Water Act (CWA) is a federal law which seeks to restore and maintain water quality in the surface waters of the United States. Section 305b of the CWA requires states to submit water quality assessment reports of the state's water resources to the USEPA. These reports include a Consolidated List which contains information about assessment of all surface waters in the state. Section 303d of the CWA requires the development and submission of a List of Impaired Waters. This 303d List of Impaired Waters is updated and submitted every two years.

IDEM's most recent water quality assessment and list of impaired waters (303d list) is published as the Indiana Integrated Water Monitoring and Assessment Report to the USEPA for 2016. This report describes water quality monitoring strategy for collecting data which plans for sampling water quality every nine years on a rotating basis throughout the state. The report addresses attainment of water quality standards for aquatic life use support, recreational use support, and support of fishable uses and for public water supplies, drinking water use.

The Little Calumet River has the following designated uses (327 IAC 2-1.5-5).

- Full-body contact recreation

- Capable of supporting a well-balanced, warm water aquatic community
- Salmonid waters (capable of supporting a salmonid fishery) for Burns Ditch downstream of the confluence with the East Arm of the Little Calumet River

The Grand Calumet River has the following designated uses (327 IAC 2-1.5-5).

- Full-body contact recreation
- Capable of supporting a well-balanced, warm water aquatic community

Lake Michigan including the shoreline and open waters in the study area has the following designated uses (327 ICA 2-1.5-5).

- Full-body contact recreation
- Public water supply
- Capable of supporting a well-balanced, warm water aquatic community
- Salmonid waters (capable of supporting a salmonid fishery) for the Indiana portion of the open waters of Lake Michigan

### 3.3.1 303d List of Impaired Waters

The 303d list of Impaired Waters categorizes rivers both by ability to attain beneficial uses, listed above, and the reason for those impairments. Indiana uses 5 categories to identify the attainment of designated uses, the availability of data for assessment, and TMDL status. These categories are:

- **1** – Attaining the water quality standard for all designated uses and no use is threatened.
- **2** – Attaining some of the designated uses; no use is threatened; and insufficient or no data and information are available to determine if the remaining uses are attained or threatened.
- **3** – Insufficient data and information to determine if any designated use is attained.
- **4** – Impaired or threatened for one or more designated uses but does not require the development of a TMDL.
    - **4A** – A TMDL has been completed.
    - **4B** – Other pollution control requirements are in place which will result in attainment
    - **4C** – Impairment is not caused by a pollutant.
- **5** – The water quality standard is not attained.
    - **5A** – Requires development of a TMDL
    - **5B** – Impaired due to mercury or PCBs or both

IDEM has submitted 303d lists for 2012, 2014, and 2016, but as of April 2018 USEPA has not issued a decision on these three lists. The draft 2018 list was published on April 11, 2018 and will be submitted to USEPA on August 31, 2018 after the comment period. The draft information indicates that segments in the Deep River/Little Calumet River/Burns Ditch will be modified to address inconsistencies in listings and to combine segments. Changes to segment designation in IDEM's 2018 Integrated Report 305b and 303d listing will be addressed in the Long-Term Control Plan.

Categories are listed in the Integrated Report for each beneficial use identified for the segment including fish consumption, recreation (primary contact), aquatic life, and water supply. A summary of segment status and identified impairments by Assessment Unit IDs (AUIDs) in the study area, as listed in Appendix I, and impairments, as listed in Appendix P of the Indiana's 2016 Integrated Report, are shown in **Table 3-2**. The Impairment status by reach is shown for Fish Consumption on **Figure 3-2,** for Recreation on **Figure 3-3,** and for Aquatic Life on **Figure 3-4.**

Illinois 303d listings for Calumet Park Beach are from the Illinois Integrated Water Quality Report and Section 303(d) List, 2016, submitted to the USEPA on July 11, 2016.

**Table 3-2. List of 303d Categories for Area of Study**

| Watershed and HUC | Segment | AUID | Fish Consumption | Recreation (Primary Contact) | Aquatic Life | Notes |
|---|---|---|---|---|---|---|
| Little Calumet River (E-W Split) 07120003030060 | West of Grant St | INK0335_01 | Impaired (PCBs - fish) | TMDL completed (*E. coli*) | Impaired (Cl-, CN-, DO, IBC, Nutrients), TMDL needed | |
| Deep River-Little Calumet River 040400010508 | Lake George to Central Ave | INC0158_01 | Partial Attainment | Partial Attainment | TMDL complete (IBC) | |
| | Grant St to Deep River | INC0158_T1005 | Impaired (PCBs - fish) | TMDL complete (*E. coli*) | TMDL complete (IBC) | CSOs 005, 015, and 013 |
| Burns Ditch 040400010509 | Central Ave to East Arm of LCR | INC0159_01 | Impaired (PCBs - fish) | TMDL complete (*E. coli*) | Impaired (IBC), TMDL needed | CSO 004 |
| | East Arm of LCR to Lake Michigan | INC0159_02 | Partial Attainment | TMDL completed (*E. coli*) | TMDL complete (IBC) | |
| Grand Calumet River – Gary 071200030406 | U. S. Steel Outfall 005 | INK0346_02 | Impaired (PCBs - fish) | Insufficient Data | Impaired (NH3, IBC, O&G), TMDL needed | (a) CSO 006 |
| | E of Virginia St to Cleveland St | INK0346_03 | Impaired (PCBs - fish) | Insufficient Data | Impaired (NH3, IBC, O&G), TMDL needed | CSOs 007, 008, 009 |
| | Cleveland St to Ship Canal | INK0346_04 | Impaired (PCBs - fish) | Impaired (*E. coli*), TMDL needed | Impaired (IBC, O&G), TMDL needed | WWTP, CSOs 010, 011, 012 |
| Indiana Harbor 040400010603 | Ship Canal | INC0163_T1001 | Impaired (PCBs - fish) | Impaired (*E. coli*), TMDL needed | Impaired (IBC, O&G), TMDL needed | |
| | Harbor | INC0163G_G1078 | Impaired (Hg, PCBs - fish) | Partial Attainment | Impaired (CN-), TMDL needed | (b) |
| | Trail Creek west to Burns Ditch | INC0163G_G1093 | Impaired (Hg, PCBs - fish) | TMDL complete (*E. coli*) | Partial Attainment | |

| Watershed and HUC | Segment | AUID | Fish Consumption | Recreation (Primary Contact) | Aquatic Life | Notes |
|---|---|---|---|---|---|---|
| Lake Michigan Shoreline 040400010603 | Burns Ditch to Indiana Harbor | INC0163G_G1074 | Impaired (Hg, PCBs - fish) | TMDL complete (*E. coli*) | Partial Attainment | (c) |
| | Indiana Harbor to Illinois Border | INC0163G_G1075 | Impaired (Hg, PCBs - fish) | TMDL complete (*E. coli*) | Partial Attainment | (c) |
| | Calumet Park, Illinois | IL_QT-03 | Impaired (Hg, PCBs - fish) | TMDL complete (*E. coli*) | Not Assessed | |

**Notes:**
303d Listing Categories
TMDL completed - Indiana Category 4A
Impaired –Fish Consumption is Indiana Category 5B, Recreation and Aquatic Life is Indiana Category 5A
Insufficient Data – Indiana Category 3
Partial Attainment – Indiana Category 2

| Impairment Abbreviations: | Hg - Mercury | DO – Dissolved Oxygen |
|---|---|---|
| | PCBs – Polychlorinated biphenyls | O&G – Oil and Grease |
| | IBC – Impaired Biotic Communities | $CN^-$ - Free Cyanide |
| | $NH_3$ – Ammonia | $Cl^-$ - Chloride |

(a) Specific criteria for Free Cyanide have been established for the Grand Calumet River from U. S. Steel outfall 005 and ending 1 mile downstream (327 IAC 2-1.5-16),

(b) Parts of the shoreline were not included in the Lake Michigan Shoreline *E. coli* TMDL due to the dredging that existed at the time of the TMDL development and the presence of a breakwater. Data is not available for the reach and it has not been listed as impaired for *E. coli*. TMDL development methods have been modified since the development of this TMDL, and this reach would have been including in the TMDL analysis and study area. Current data, within the last 5 years is not available for this reach. (email from Jody Arthur 10/15/2015)

## 3.3.2 TMDLs

TMDL determinations are a regulatory tool to address water quality in impaired waterbodies. They are required as part of the CWA if an impairment is identified as part of the assessment of water bodies. TMDLs have been developed for the Lake Michigan Shoreline, the Little Calumet and Portage Burns Waterway, the Deep River-Portage Burns Watershed, and Salt Creek, a tributary to the East Arm of the Little Calumet River. A study to support TMDL development for the Grand Calumet River was also completed by the USACE.

### 3.3.2.1 Lake Michigan Shoreline

The Lake Michigan Shoreline TMDL for *E. Coli* Bacteria was published in August 2004 (Tetra Tech). It addresses *E. coli* impairment along the Lake Michigan shore that contains numerous beaches and parks including the Indiana Dunes National Lakeshore. Violations of water quality standards for *E. coli* result in beach closures. As part of the TMDL development, loads were estimated for point and non-point sources. Non-point sources include septic system, wildlife, swimmers, boaters, and loads from tributaries including the Portage-Burns Waterway.

In order to meet water quality standards, load allocations were developed for these non-point sources. The load allocations assume that all concentrations in tributaries are a maximum of 125 cfu/100mL. This is more stringent than current water quality standards which require the geometric means to be 125 cfu/100mL with a maximum concentration of 235 cfu/100mL. These load allocations require a 77% reduction in loads from Burns Ditch and an 18% reduction in loads from the Indiana Harbor Canal. Load reductions were also developed for other tributaries and non-point sources.

Illinois has developed a TMDL for the Lake Michigan shoreline including Calumet Beach (RTI International 2013) which is included in the western end of the study area for this report. The area includes the beach within Calumet Park, including Munson Beach, located east of E $102^{nd}$ St. Water quality issues, including beach closures, were attributed to an excessive goose population, potential for impact from stormwater flow from the Calumet River, which discharges to Lake Michigan north of the beach, and stormwater outfalls near the beach and from nearby parking lots (RTI International 2013).

#### 3.3.2.2 Grand Calumet

The USACE completed a TMDL Study for the Grand Calumet River and Indiana Harbor Canal Watershed on behalf of IDEM in 2004 (USACE 2004). The study looks at water quality for section of the Grand Calumet River in Gary (East Branch) and the Grand Calumet River west of the Indian Harbor Canal (West Branch) in addition to the Indiana Harbor Canal. TMDL recommendations were developed for chloride, ammonia, cyanide, oil & grease, mercury and PCBs/pesticides.

The following TMDL recommendations were developed:

- Reduce effluent concentrations of chloride for the Hammond Sanitary District outfall (West Branch)
- Monitor potential sources of free cyanide to ensure National Pollutant Discharge Elimination System (NPDES) permit discharge standards are achieved
- Sediment cleanup to remove source of oil & grease, PCB and free cyanide contamination
- Mercury will be addressed separately

#### 3.3.2.3 Little Calumet and Portage Burns Waterway

Little Calumet and Portage Burns Waterway TMDL for *E. coli* Bacteria Final TMDL Report was published in September 2004. The TMDL addresses *E. coli* impairment 30 miles of the Little Calumet – Portage Burns Waterway including the East Arm of the Little Calumet River and the Portage Burns Ditch west to the Deep River. The TMDL will require over 90% of nonpoint source loads including loads to upstream tributaries. This TMDL is not designed to address CSO contributions which will be addressed by LTCPs and NPDES permits.

#### 3.3.2.4 Deep River-Portage Burns Watershed

The Total Maximum Daily Load Report for the Deep River-Portage Burns watershed was published as a draft report in July 2014 (IDEM 2014). This TMDL includes a portion of the Little Calumet River that flows east into the Portage-Burns Canal, the Portage-Burns Canal itself, Willow Creek, the Deep River and the contributing tributaries to the Deep River including Lake George and upstream tributaries. A total of 29 Assessment Units (AUIDs) in the watershed are listed as impaired. The report establishes TMDLs to address *E. coli,* phosphorus, dissolved oxygen, impaired biotic communities and siltation.

Potential sources for the impairments include point and non-point sources. Point sources include WWTPs, separated storm sewers systems, combined sewer and sanitary sewer overflows, industrial facilities and construction. Non-point sources include urban storm water and agricultural runoff. Within the watershed there are two CSO communities (Gary and Crown Point) and 15 municipal separate storm sewer system (MS4) entities. TMDL report identifies locations for focused implementation activities including outreach and education, conservation easements, nutrient management, agricultural and animal management and low-impact development and stormwater best management practices.

Target values were established as a basis for calculating the allowable daily loads. A target value of 125 cfu/100mL was established for *E. coli.* There is a waste load allocation for the Gary Sanitary District CSOs of 3.49 billion/day for *E. coli,* 0.98 lbs/day of total phosphorus and 98.37 lbs per day of TSS.

The wasteload allocations (WLAs) for all the CSOs were calculated to be equal to the average observed daily flow multiplied by the TMDL target value of 235 MPN/100 mL for *E. coli*, 0.3 mg/L for total phosphorus, and 30 mg/L for total suspended solids.

To support the development of the TMDL, additional data was collected to support a reassessment of the water quality. This included collection of *E. coli* data and assessment of fish and sediment community health. This data is included in analysis of water quality in **Section 3.5** of this report.

#### 3.3.2.5 Salt Creek

The Salt Creek *E. coli* TMDL was published in March 2004. Salt Creek is a large tributary to the East Arm of the Little Calumet River. The goal of the TMDL was to improve water quality in order to achieve the recreational use standard. A load reduction of 88% is required to meet the target conditions (WHPA 2004). Salt Creek is outside of the GSD study area, however reductions in *E. coli* loads in order to meet the TMDL will reduce the *E. coli* load to the Burns Ditch and to Lake Michigan.

## 3.4 Water Quality Data Sources

This section summarizes the available water quality data for the Little Calumet River, Grand Calumet River and Lake Michigan beaches. The analysis uses available water quality data collected during the last 20 plus years (1998 to early 2018) within the study area data. The data was collected and reported by various organizations including the States of Indiana and Illinois, USGS, and beach monitoring programs. This data was combined with water quality data collected by GSD and reported in previous studies. **Figure 3-5** shows the water quality sample locations in the study area for water quality data presented in **Section 3.5**. Water quality data for the Deep River upstream of the confluence with the Little Calumet River and for the East Arm of the Little Calumet River were included to provide data on upstream water quality.

Data sources include:

- GSD Baseline and 2013 Sampling
- Deep River-Portage Burns Baseline TMDL Study

- EPA Storet database
- BEACH and BeachGuard databases
- USGS NWIS (National Water Information System) Database

### 3.4.1 Gary Sanitary District Baseline Sampling

Water quality data was collected by the Gary Sanitary District for the Grand Calumet and Little Calumet Rivers between 1999 and 2003. *E. coli* concentrations were measured for instream and CSO overflows. Data for the Little Calumet River was reported in the Stream Reach Characterization and Evaluation Report (Greely and Hanson 2002) and a memorandum to IDEM and USEPA (CDM 2004). Data for the Grand Calumet River water quality sampling was reported in the GCR Stream Reach Characterization and Evaluation Report (Greeley and Hanson 2003) and the Grand Calumet River and Indiana Harbor Ship Canal CSO Discharge Impact Initial Assessment Study (Greeley and Hanson 2001). Data from these sampling activities is included in the water quality assessment in **Section 3.5**.

### 3.4.2 Updated (2013) Water Quality Monitoring Results

Additional in-stream water quality data was collected at 13 sites in the Little Calumet River (8 sites) and the Grand Calumet River (5 sites) during the period from August through October 2013. This data collection program included three separate monitoring efforts:

- Temperature Gradient Study (TGS)
- Fixed-Day Monitoring
- Wet Weather Monitoring

A Quality Assurance Project Plan (QAPP) was prepared and submitted to USEPA on July 15, 2013 and was approved by USEPA on August 12, 2013. Data collection began on August 6 in anticipation of approval of the QAPP.

Each of the three monitoring efforts is discussed individually in the following sections. Additional detail about the specific procedures and methods for data collection, handling and analysis is described in the QAPP. Following the individual summaries of each monitoring effort is a summary of the results of the program. Additional detail about the findings of each element of the monitoring program is available in the following reports submitted previously to USEPA and IDEM:

- Temperature Gradient Study — October 3, 2013
- Fixed-Day Sampling Data – August 2013 — October 15, 2013
- Wet-Weather Sampling Data – September 18, 2013 — November 1, 2013
- Fixed-Day Sampling Data – September 2013 — November 14, 2013
- Fixed-Day Sampling Data – October 2013 — December 13, 2013
- Wet-Weather Sampling Data – October 30, 2013 — December 17, 2013

#### 3.4.2.1 Temperature Gradient Study

The TGS effort evaluated the potential for thermal stratification in the Grand Calumet River (Grand Calumet River) to occur during wet weather events. The potential for thermal stratification was identified in large part due to the relatively large contribution in Grand Calumet River flow from the U.S. Steel facility that discharges to this waterbody, both upstream and downstream of the CSO outfalls. One storm (the September 18, 2013 event) was selected based on the potential to create maximum stratification (i.e., large enough to initiate CSO discharge from upstream CSO 009 but small enough to limit in-stream mixing effects). Temperature data was collected continuously over a 72-hour period with reporting at 5-minute intervals from three different depths (surface to ¼ depth, ½ depth and ¾ depth) at the Buchanan Street bridge location following the initiation of CSO 009 discharge. The Buchanan Street bridge is located downstream of CSO 009.

The data were analyzed for the occurrence of significant vertical stratification in temperature (defined as a difference of one degree Celsius or greater between the uppermost and lowest sample depths), which would indicate the potential for significant differences in bacteria and DO concentrations across the depth of the waterbody during wet weather. This in turn would have required multiple depth sampling in the Grand Calumet River for the Fixed-Day and Wet Weather Monitoring efforts.

However, the data exhibited no temperature difference of one degree Celsius or more between the lowest and uppermost vertical monitoring depths at any of the recorded time steps during the selected event (see **Figure 3-6**). It was therefore concluded from these data that there is no significant vertical stratification of the Grand Calumet River during or following wet weather events, and therefore no need for multiple depth samples for the fixed day or wet weather monitoring tasks.

#### 3.4.2.2 Fixed-Day Monitoring

This effort was intended to evaluate in-stream bacteria conditions consistent with the same geo-mean-based sampling protocol used to determine compliance with Indiana's water quality standards for *E. coli*. During the three-month monitoring period grab samples were collected at five locations on the Grand Calumet River and eight locations on the Little Calumet River and analyzed for *E. coli*. These samples were collected on five pre-determined evenly-spaced days per month (regardless of weather conditions) in both the Grand Calumet River and Little Calumet River. A single grab sample was collected at each location on the Grand Calumet River and Little Calumet River from the waterbody surface (1.5 to 2-foot depth, pursuant to the TGS). Additional data (in-situ measurements for DO, temperature, and conductivity) were also collected at the same depth as the sample.

#### 3.4.2.3 Wet Weather Monitoring

The wet weather monitoring effort was intended to provide additional data describing in-stream bacteria (*E. coli*) concentrations during wet weather events. Data from wet weather monitoring, in conjunction with the fixed-day monitoring, are intended to supplement the larger datasets collected during the previous in-stream monitoring period (1998 through 2003), and to reflect more current conditions in these water bodies.

USEPA requested that GSD collect bacteria samples at the same locations as the fixed-day monitoring program during three wet weather events on each receiving stream (i.e., the Grand Calumet River and Little Calumet River). However, only two events (September 18 and October 30) during the monitoring period met the criteria established in the QAPP for event selection. Bacteria grab samples were collected for both events at the surface (1.5 to 2-foot depth) at each sampling station.

#### 3.4.2.4 Summary of Updated (2013) In-Stream Monitoring Results

The data collected in the monitoring program described above expand the available dataset describing current conditions in the subject water bodies during both fixed-day and wet-weather periods. These data support an improved understanding of overall water quality conditions. Additionally, the WQ model has been re-validated using the updated (2013) WQ monitoring data, as described at the end of this section.

The data collected during the 2013 monitoring program generally confirm the understanding of bacteria conditions in these water bodies developed from the prior monitoring and modeling work described below in **Section 5.3** of this report. In both water bodies, relatively large precipitation events (greater than ¼ inch) were necessary to trigger CSO discharges and the resultant elevated bacteria levels in-stream. This is particularly true in the Grand Calumet River, where a precipitation event of nearly ¾ inch caused only a very minor bacteria response in-stream.

Following is a summary of the findings of this program specific to each of the two major water bodies. The complete data and more detailed discussions of results are available in the reports listed above.

*Grand Calumet River*

Bacteria (*E. coli*) concentrations in the Grand Calumet River continue to fall well within the geomean standard of 125 MPN/100 mL, as shown on **Table 3-3**, and only occasional and relatively brief excursions above the instantaneous (single-sample) standard of 235 MPN/100 mL were observed. During the fixed day sampling program, only one sample exceeded 235 MPN/100 mL (the highest value measured was only 308 MPN/100 mL). The two wet weather sampling periods showed that during significant wet weather events, sufficiently large to trigger CSO discharge, *E. coli* levels spike within 6 hours following the start of the event in the Grand Calumet River, but consistently return to near baseline levels relatively quickly (between 24 and 48 hours). **Figures 3-7 through 3-11** show *E. coli* levels measured in the Grand Calumet River during both the fixed day and wet weather event sampling programs.

As noted above, dissolved oxygen concentrations were also collected *in situ* during each sampling event at each site. These data show that the dissolved oxygen conditions in the Grand Calumet River are good, with almost all measurements showing DO above 4.0 mg/L. However, DO concentrations did decrease in the downstream direction and reached levels of possible concern at the downstream-most site (Kennedy Avenue). However, as temperatures dropped later in the fixed day sampling period (see **Figure 3-17**), DO levels rose significantly. It should also be recognized that both lower DO and higher *E. coli* concentrations in the downstream reaches of the Grand Calumet River may have been caused in part by USEPA dredging operations in this area.

### *Little Calumet River*

Bacteria (*E. coli*) concentrations in the Little Calumet River generally are not within the geomean standard of 125 MPN/100 mL, although they are generally low for an urban water body. At all but one site (Colorado Street Bridge site), geomean concentrations are below 200 MPN/100 mL consistently throughout the three-month fixed day sampling period (see **Table 3-3**). There are also occasional and relatively brief excursions above the instantaneous (single-sample) standard of 235 MPN/100 mL. Those excursions occurred somewhat more frequently than in the Grand Calumet River and persisted somewhat longer. However, of the 15 sampling days during the fixed day program, only 3 days exhibited excursions above the 235 MPN/100 mL standard at a majority of the 8 sampling sites. During the two wet weather sampling periods, *E. coli* levels spiked within 6 hours following the start of the event in the Little Calumet River, but unlike the Grand Calumet River, levels remain elevated for more than 72 hours. **Figures 3-12 through 3-16** show *E. coli* levels measured in the Little Calumet River during both the fixed day and wet weather event sampling programs.

The dissolved oxygen concentration measurements in the Little Calumet River show that DO conditions in the Little Calumet River are generally good, although concentrations tend to vary over a significantly greater range than in the Grand Calumet River, and there are occasional excursions below 4.0 mg/L, especially at the Clark Road Bridge site. However, this site is upstream of the CSO outfalls on the Little Calumet River, and DO concentrations generally increased in the downstream direction (to the east), suggesting that CSO discharges are not responsible for DO excursions in the Little Calumet River. As with the Grand Calumet River, as temperatures dropped later in the fixed day sampling period (see **Figure 3-18**) DO levels improved significantly in the Little Calumet River.

**Table 3-3. Geomeans of Instream *E. coli* Concentrations (August through October 2013)**

| | Sample Location | August 2013 (MPN/100 mL) | September 2013 (MPN/100 mL) | October 2013 (MPN/100 mL) |
|---|---|---|---|---|
| | Little Calumet River | | | |
| B1 | South Cline Avenue Bridge | 34.2 | 61.2 | 25.2 |
| B2 | Clark Road Bridge(1) | 174.9 | 72.0 | 138.1 |
| B3 | Colorado Street Bridge(2) | 213.3 | 273.5 | 264.9 |
| B4 | Deep River at Liverpool Road Bridge | 26.7 | 30.2 | 94.1 |
| B5 | US Highway 20 / Melton Road Bridge | 147.5 | 152.4 | 182.0 |
| B6 | Burns Ditch near Doyne Marina(3) | 137.7 | 170.3 | 127.6 |
| B7 | Burns Ditch near Portage Marina | 118.7 | 191.1 | 168.8 |
| B8 | East Branch near Crisman Road Bridge | 125.6 | 174.8 | 191.3 |
| | Grand Calumet River | | | |
| B9 | Tennessee Street Bridge | 27.8 | 5.7 | 12.7 |
| B10 | Buchanan Street Bridge | 16.9 | 19.0 | 13.5 |
| B11 | EJ&E Railroad Bridge | 10.2 | 35.3 | 26.6 |
| B12 | North Cline Avenue Bridge | 14.4 | 18.8 | 13.5 |
| B13 | Kennedy Avenue Bridge | 30.6 | 26.0 | 13.7 |

**Notes:**
(1) Located added at the request of USEPA.
(2) Location moved from Martin Luther King Drive to Colorado Street Bridge due to access and safety concerns.
(3) Location added by agreement of USEPA and GSD.

### 3.4.3 Deep River - Portage Burns Baseline Study

IDEM conducted sampling in the Deep River watershed including downstream of the GSD CSOs in the Little Calumet River (IDEM 2018a). Sampling was conducted to assess the current status of biotic communities and aquatic health and provide data for development of a TMDL. Samples were collected and analyzed for *E. coli* and nutrients throughout the watershed.

### 3.4.4 EPA Water Quality Data (STORET)

The USEPA maintains a database called STOrage and RETrieval (STORET) as a repository for water quality, biological, and physical data (USEPA-STORET 2018). This database compiles Watershed Summary Reports by organization for a specific Drainage Basin/HUC. Collected data type is categorized as biological, habitat, metal, microbiological and contaminants, nutrient, physical, PAHs, PCB, pesticide, radiation, and other. Watershed Station Summary includes information about the organization responsible for collecting the data, as well as counts per station and/or characteristic group. Summaries of water quality data obtained for the study area are presented in **Table 3-4.** Data downloaded from STORET is included in **Appendix 3-1**.

Organizations that submit data to the database include the National Park Service, Illinois Environmental Protection Agency (IEPA), Michigan Department of Environmental Quality (MDEQ), Indiana Department of Environmental Management (IDEM) and lake sampling programs.

**Table 3-4. Summary of STORET Water Quality Data for Study Area**

| | Date Range | | | Number of Results by Characteristic Group Type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Organization Name | Start | End | Number of Sample Locations | Biological, incl. Macroinvertebrates | Metal | Microbiological, Contaminants | Nutrient | PAHs/PBDE/PCB/Pesticides | Physical | Habitat/Sediment | Not Assigned/Other/Radiation | Total Number of Results |
| National Park Service Water Resources Division | May-06 | Sep-17 | 23 | 85 | 100 | | 261 | 7439 | 2252 | 60 | 13061 | 23258 |
| Illinois Department of Public Health | May-07 | Sep-17 | 1 | | | 963 | | | | | | 963 |
| IDEM | May-06 | Sep-17 | 138 | | 2383 | 33396 | 752 | 868 | 2217 | | 1299 | 40915 |
| MDEQ | Aug-92 | Sep-17 | 71 | 629 | 110 | 5200 | 36 | 348 | 376 | | 196 | 6895 |
| GLEON Lake Observer | Jul-15 | Jul-15 | 1 | | | | | | 2 | | | 2 |
| IEPA | Jun-00 | May-17 | 100 | 2886 | 25512 | | 5637 | 2788 | 10890 | 559 | 6076 | 54348 |
| Indiana STORET | Aug-89 | Jan-18 | 483 | 338 | 122002 | 5369 | 38808 | 62953 | 124099 | 172 | 69625 | 423366 |
| Metropolitan Water Reclamation District of Greater Chicago | Jan-00 | Jul-03 | 37 | 684 | 37128 | 2765 | 7248 | | 15268 | | 19826 | 82919 |
| North American Lake Management Society | Jul-96 | May-16 | 9 | | | | | | 69 | | 69 | 69 |

| Organization Name | Date Range | | Number of Sample Locations | Number of Results by Characteristic Group Type | | | | | | | | Total Number of Results |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Start | End | | Biological, incl. Macroinvertebrates | Metal | Microbiological, Contaminants | Nutrient | PAHs/PBDE/PCB/Pesticides | Physical | Habitat/Sediment | Not Assigned/Other/Radiation | |
| USEPA Great Lakes National Program | Sep-80 | May-14 | 396 | 2927 | 3296 | | 321 | 125144 | 2768 | 55 | 17034 | 151545 |
| Illinois RiverWatch Network | Jul-96 | Aug-16 | 41 | 1842 | | | | | 1777 | 5407 | | 9026 |
| USEPA National Aquatic Resources Survey (NARS) | Jan-04 | Jul-04 | 2 | 84 | 15 | | 10 | | 196 | 2435 | 90 | 2830 |

### 3.4.5 Beach Monitoring Data

Beach data were collected from two different sources, the IEPA-Beach Advisory and Closing On-line Notification (BEACON; USEPA-BEACON 2018) database and the Indiana BeachGuard System (IDEM-BeachGuard System 2018).

BEACON is a database of pollution occurrences for coastal recreation waters that contains state-reported beach monitoring and notification data. Data is given by State/County/HUC, including water quality and possible pollution sources. BEACON-Water Quality Reports presents details of water quality monitoring results collected for the beach program (from WQX/STORET) including: beach ID, beach name, sampling station ID, date/time of sample, collection method, characteristic(s) (e. g., pathogen indicator) sampled, results, analytical method, statistic type (e. g. geometric mean). Pollution Sources identifies if possible pollution sources have been investigated or associated with a Beach Action and, if so, what are the possible sources that might affect beach water quality. There is other beach information available at the database related to advisories and monitoring, beach actions, beach attributes, and beach monitoring frequency.

The State reported data found in BEACON come from three main databases:

- Reach Address Database (RAD): contains geographic data that define each beach's location and the location of water quality monitoring station.
- STOrage and RETrieval (STORET) database and Water Quality Exchange (WQX): repository of the water quality monitoring data collected by water resource management groups across the country.
- PRogram tracking, beach Advisories, Water quality standards, and Nutrients (PRAWN): stores beach administrative, advisory and closing data.

In order to cover a broader period of time and list of beaches in the study area, Indiana BeachGuard System (IDEM-BeachGuard System 2018) was also used to download relevant water quality information. This database contains data for Indiana's Lake Michigan coastal and statewide inland beaches, as well as many other inland (i. e. non-Lake Michigan) beaches in Indiana at which *E. coli* monitoring is being conducted. Data related to beach advisories/closings, sampling schedules, *E. coli* test results, and miscellaneous parks is published and available to download on-line. Accessed data includes the Indiana Water Quality Report, the Indiana Possible Pollution Sources, and the Beachguard Data Export.

### 3.4.6 USGS NWIS Database

The USGS NWIS database was queried to obtain samples within the study area (USGS WaterData 2016). The USGS NWIS Data is taken from a database which provides access to water-resources data collected across the United States from 1.9 million sites. Along the Little Calumet River and Grand Calumet River, a total of 282 samples were obtained from the NWIS database, including 88 *E. coli*, 46 DO, 111 TSS, and 37 Total Phosphorus samples. The data was taken from a total of 21 separate locations, 19 of which are located on the Grand Calumet River and 2 of which are located on the Little Calumet River. Samples were taken from a time period spanning 19 years, from July 27, 1999 to April 16, 2018.

## 3.5 Assessment of Water Quality Data

Water quality data for the impairments listed in the 303d and for parameters addressed by TMDLs was selected for each waterway. The data was plotted along the waterways to illustrate the spatial density of data. The data compared to water quality standards to assess the availably of data and status of the waterways. If sufficient data was available, statistics were developed and compared to water quality standards. Parameters for each waterway include:

- For the Little Calumet River
  - *E. coli*
  - Dissolved Oxygen
  - Total Phosphorus
  - TSS
- For the Grand Calumet River
  - *E. coli*
  - Dissolved Oxygen
  - Total Phosphorus
  - Ammonia
  - TSS
- For Lake Michigan
  - *E. coli*

Water quality data was compared to the Indiana *E. coli* limits for recreation uses single sample maximum of 235 cfu/100mL. If there are more than 10 samples in a 30-day period at the site, up to 10% of the samples can exceed 235 cfu/100mL.

Water quality data for other parameters was compared to the water quality standards as applicable.

### 3.5.1 Little Calumet River

Water quality data collected for *E. coli* includes both wet weather sampling, specifically collected to measure the impact of CSOs during overflow events, dry weather sampling and periodic sampling for other reasons. All the *E. coli* data for the Little Calumet River which was identified as part of this data compilation effort is summarized in **Figure 3-19** by presenting water quality results at all sampling locations along a profile of the Little Calumet River. Data collected by GSD specifically to measure water quality during wet weather events and known CSO discharge periods is shown in red, other data is shown in green. The data location along the x-axis in the graph correspond with the location along the river. A map of the locations is shown above the graph. CSO overflow locations are shown for reference. In addition to the water quality locations on the Little Calumet River, points upstream on the Deep River and the East Arm of the Little Calumet River were included for reference.

**Figure 3-19** illustrates the range of concentrations observed, the density (number of sample points) and spatial distribution of the data. Plots are provided for data for the last 20 years (1998 to 2018) to provide an understanding of the extensive sampling that has occurred in the watershed. **Figure 3-20** shows data collected during the last 5 years (2013 to 2018) and includes data collected for the Deep River baseline study. Data from locations with a high number of sampling events are shown on **Figure 3-21** with the average daily discharge at the Little Calumet River/Burns Ditch (USGS gage 04095090) for each sample date plotted on the x-axis and the observed *E. coli* counts on the y-axis. High discharge days are assumed to represent wet weather conditions and low to average discharge days are assumed to represent dry weather conditions. Data is shown for the last 20 years of sample results (1998 to 2018) with data from the last 5 years (2013 to 2018) shown in orange. During periods of low and high flows *E. coli* counts regularly exceed the water quality standards. The sample locations did not have frequent enough evenly spaced samples to allow for calculation of a geomeans.

**Figure 3-22** shows the data obtained for dissolved oxygen for the last 20 years (1998 through 2018). In most areas, the DO standard of 5 mg/L was achieved. **Figure 3-23** shows only DO sample results from the last 5 years. Locations at Clark St, Colorado St, LMG-05-0002 and LMG0060-0012 had samples with DO below the standard of 5 mg/L. **Figure 3-24** shows scatter plots of DO concentration compared to mean daily river discharge.

**Figure 3-25** shows the data obtained for TSS for the last 20 years. The TSS standard is regularly exceeded, particularly for the sampling locations collected during wet weather, shown in red. **Figure 3-26** shows data from the last 5 years. Data for TSS is limited and sample locations are near the Burns Ditch. **Figure 3-27** shows TSS concentrations compared to mean daily river discharge at Burns Ditch. Generally, concentrations increase with increased river discharge.

**Figure 3-28** shows the data obtained for total phosphorus for the last 20 years. **Figure 3-29** shows the data for the last 5 years. Data is limited to 4 sample locations. **Figure 3-30** shows comparisons of total phosphorus concentrations and mean daily river discharge. Concentrations of total phosphorus are generally below water quality standards but do increase with increased river discharge.

### 3.5.2 Grand Calumet River

**Figure 3-31** shows the data obtained for *E. coli* for the Grand Calumet for the last 20 years (1998 to 2018). The sample location map shows the locations of the Gary WWTP outfall and CSOs on the Grand Calumet River. Water quality samples collected as part of GSD wet weather sampling events are shown in red. **Figure 3-32** shows the *E. coli* results plot on the y-axis and the mean daily discharge in the Grand Calumet River (USGS gage 04092677) on the x-axis. *E. coli* results collected in the last 5-years are shown in orange. Exceedances of *E. coli* water quality standards occur in both wet and dry weather.

**Figure 3-33** shows the data obtained for DO for the last 20 years. Most samples are above the 5 mg/L standard. **Figure 3-34** shows the DO concentration compared to daily mean river discharge at two locations. Concentrations drop along the river, but remain above the minimum value of 4 mg/L.

**Figure 3-35** shows the data obtained for Total Phosphorus for the last 20 years. Most samples are below the 0.3 mg/L. **Figure 3-36** shows the Total Phosphorus concentration compared to daily mean river discharge at two locations. Concentrations do not appear to vary with river discharge.

**Figure 3-37** shows the data obtained for TSS for the last 20 years. **Figure 3-38** shows the TSS concentration compared to daily mean river discharge at two locations. Concentrations do not appear to vary with river discharge, but there are some exceedances of 30 mg/L.

**Figure 3-39** shows the data obtained for Ammonia for the last 20 years. **Figure 3-40** shows the ammonia concentration compared to daily mean river discharge at two locations. Concentrations do not appear to vary with river discharge.

### 3.5.3 Lake Michigan Shoreline

Water quality data for the Lake Michigan shoreline was collected at beach locations, generally during the recreation season. Analysis of *E. coli* data shows that water quality is better in some sections of the shoreline than other. **Figure 3-41** shows the percentage of water quality samples collected from 2013 to 2018 at each beach location that exceeded the maximum standard of 235 cfu/100mL. Beaches between the Illinois/Indiana border and the US Steel facility in Gary have more frequent exceedances of the 235 cfu/100 mL standard. On average 15.5% of the samples exceeded the criteria. Between the US Steel facility in Gary to the mouth of the Little Calumet River, an average of 3.8% of the samples exceeded the criteria. West of the mouth of the Little Calumet River an average of 8.3% of the standards exceeded the criteria. The following discussion presents water quality samples for the Lake Michigan shoreline grouped as shown on **Figure 3-41**. Mean discharge data for scatter plots is from the Little Calumet River for the areas east of the US Steel facility and from the Grand Calumet River areas west of the US Steel facility. Mean river discharge was plotted in order to show concentrations relative to dry and wet conditions and does not mean that the *E. coli* source is from the Little Calumet River or Grand Calumet River.

**Figure 3-42** shows the observed water quality results for *E. coli* for beach sampling locations along the Lake Michigan shoreline from Calumet Park in Illinois to the US Steel facility in Gary Indiana, just west of the Indiana Harbor. Detections vary and occasionally exceed 235 cfu/100mL, the single sample standard which requires beach closures. Data labeled as “To Numerous to Count” are shown at the maximum reported value **Figure 3-43** shows the mean river discharge, based on the Grand Calumet River (USGS gage 04092677) versus the water quality results for *E. coli* at selected locations. Blue dots are data points collected prior to 2013. Orange shows data points collected from 2013 to 2018. The results do not show a correlation between river flow and exceedances of water quality criteria for *E. coli.* Data labeled as “To Numerous to Count” are shown at the maximum reported value.

**Figure 3-44** shows the observed water quality results for *E. coli* for beach sampling locations along the Lake Michigan shoreline from the US Steel facility in Gary Indiana, just west of the Indiana Harbor to the Little Calumet River discharge to Lake Michigan. Detections vary and occasionally exceed 235 cfu/100mL, the single sample standard which requires beach closures. Data labeled as “To Numerous to Count” are shown at the maximum reported value. **Figure 3-45** shows the mean river discharge, based on the Little Calumet River/Burns Ditch (USGS gage 04095090) versus the water quality results for *E. coli* at selected locations. Blue dots are data points collected prior to 2013. Orange shows data points collected from 2013 to 2018. The results do not show a correlation between river flow and exceedances of water quality criteria for *E. coli.* Data labeled as “To Numerous to Count” are shown at the maximum reported value.

**Figure 3-46** shows the observed water quality results for *E. coli* for beach sampling locations along the Lake Michigan shoreline from the Little Calumet River west to Michigan City. Detections vary and occasionally exceed 235 cfu/100mL, the single sample standard which requires beach closures. Data labeled as “To Numerous to Count” are shown at the maximum reported value. **Figure 3-47** shows the mean river discharge, based on the Little Calumet River/Burns Ditch (USGS gage 04095090) versus the water quality results for *E. coli* at selected locations. Blue dots are data points collected prior to 2013. Orange shows data points collected from 2013 to 2018. The results do not show a correlation between river flow and exceedances of water quality criteria for *E. coli.* Data labeled as “To Numerous to Count” are shown at the maximum reported value.

### 3.5.4 Summary of Water Quality Data

The water quality indicates that improvements are required in order to meet standards for designated sues of the waterways. In particular:

- *E. coli* standard are exceeded in the Little Calumet River for both low and high flow conditions.
- DO concentrations drop below standards at locations in the Little Calumet River and TSS and total phosphorus concentrations increase with river flow.
- *E. coli* standards have been historically exceeded in the Grand Calumet River.
- DO concentrations are occasionally low at locations in the Grand Calumet River. Total phosphorus and TSS concentrations are low and generally meet standards. Total phosphorus, TSS and ammonia concentrations do not show increases or decrease depending on flow conditions.

- *E. coli* standards are exceeded along the Lake Michigan shoreline, resulting in beach closures. However, there does not appear to be correlation between wet weather (high river flow periods) and *E. coli* exceedances.

- On average from 2013-2018, 15.5% of the water quality samples exceed the single sample criteria of 235 cfu/100mL for *E. coli* at beaches between Calumet Park in Illinois and the US Steel Facility in Gary, Indiana. Between the US Steel Facility and the Little Calumet River, exceedances of the single sample criteria are lower, averaging 3.8%. West of the Little Calumet River to Michigan City, the single sample criteria exceedances rate averages 8.3%.

## 3.6 Pollutants of Concern

This section identifies all current and future POCs from both point and non-point sources within the Little Calumet River and Grand Calumet River watersheds. This includes sources that impaired or contribute to the impairment of one or more designated uses (fish consumption, primary contact recreation, aquatic life) of the waterbodies. Pollutants of concern were identified from the impairment listings from the 305b/303d listings and from developed TMDLs discussed in **Section 3.3** of this report

### 3.6.1 Little Calumet River

The following are POCs identified for the Little Calumet River from the East-West Flow spit east to the Portage-Burns Waterway and Burns Ditch connection with Lake Michigan:

- *E. coli*
- Dissolved Oxygen
- Total Suspended Solids
- Total Phosphorus
- PCBs
- Fecal coliform

Based on the 2004 LCR TMDL and 2014 Deep River-Portage Burns Waterway TMDL, *E. coli* sources for both dry and wet weather are present in the Deep River, Little Calumet River and Portage-Burns Waterway. Identified sources include storm runoff, combined sewer overflows, leaking and failing septic systems, wildlife, unregulated storm water, unregulated animal operations and the Hobart WWTP. Water quality data from the LCR for *E. coli*, discussed in **Section 3.4**, shows that *E. coli* counts exceed standards during dry and wet weather.

*E. coli* is also included as a POC based on the 2004 Lake Michigan Shoreline TMDL which establishes load allocations for the LCR discharge into Lake Michigan. Potential sources for the *E. coli* impacts to Lake Michigan shoreline beaches include residential septic systems, boaters, swimmers, beach sands and algae, and wildlife in addition to discharges from tributaries to the Lake.

DO, TSS and Total Phosphorus (Total P) are identified as POCs from the 2014 Deep River-Portage Burns Waterway TMDL. River stretches with Impaired Biotic Communities (IBC) have been identified in Little Calumet River and in the Portage Burns Waterway. Sources of these POCs (DO, TSS, Total P) include erosion and runoff according to the TMDL.

PCB impairments identified in the LCR, Deep River, and Burns Ditch are from sediment sources. This contamination is not associated with existing discharges from the Gary Sanitary District.

The flow in the Little Calumet River west towards Illinois is dominated by flows from Hart Ditch. The current receiving water model does not indicate that *E. coli* bacteria from CSOs are transported to the west. Since *E. coli* is a subgroup of fecal coliform and *E. coli* loads from the CSOs are not shown to flow west, fecal coliform will not be retained as a potential pollutant of concern for this study.

Future POCs may be identified for the Little Calumet River west of the E-W flow divide. A TMDL has not been developed for this reach. Based on the 303d listing, chloride, cyanide and nitrogen may be considered in addition to the POCs listed above in order to achieve the aquatic habitat designated.

In addition, the 2014 Deep River-Portage Burns Waterway TMDL did not specify loads for nitrogen. A numeric standard has not yet been developed for nitrogen based on toxicity and other harmful effects to aquatic communities. Since there is no current standard for nitrogen, a TMDL for nitrogen was not completed.

### 3.6.2 Grand Calumet River

The following are POCs identified for the Grand Calumet River in Gary from the US Steel Outfall 005 west to the Indiana Harbor Canal and the Indiana Harbor Canal to the connection with Lake Michigan:

- *E. coli*
- Dissolved Oxygen
- Total Suspended Solids
- Total Phosphorus
- Ammonia
- Oil & Grease
- Cyanide
- PCBs

The USACE 2004 TMDL study indicates that cyanide, oil & grease and PCBs are likely related to sediment and will be addressed by on-going sediment remediation activities. *E. coli*, and DO, TSS, total P and Ammonia are retained as potential pollutants of concern for this study because of the potential for impacts to aquatic life and the potential for discharge of *E. coli* to the Lake Michigan shoreline.

Water samples of WWTP influent and effluent are analyzed quarterly for cyanide and included on DMR submissions. Review of the DMRs since 2010 show that cyanide was not detected in the plant influent or effluent.

Water samples of WWTP Influent and effluent are analyzed for oil & grease five times per week and included on DMR submissions. For the period from October 1, 2017 to October 1, 2018, seventy-seven percent of influent samples were below the standard of 10 mg/L. All effluent samples were below the standard.

As noted above, water quality data for PCBs is not available for the plant influent and effluent. The GSD does analyze samples from bar screening grit and digested sludge to allow for appropriate disposal of these solids. Results from the last three years of data (January 2016 through November 2018, had low levels of PCB concentrations ranging from non-detect up to 25 mg/Kg. Samples from the sludge had the lowest concentrations with a maximum PCB concentration of 2.4 mg/Kg. For perspective, PCBs concentrations must be below 50 mg/Kg to allow for disposal in a non-hazardous waste landfill.

The 2004 TMDL Study for the GCR/Indiana Harbor Canal Watershed (USACE 2004) states that all point sources and in-stream PCB water samples were non-detect. The TMDL Study indicates that PCBs in the bottom sediments of the river system are from legacy pollution related to the historic industrial uses in the area.

# Section 4

# Sensitive Areas and Beneficial Uses

This section describes both Sensitive Areas and Beneficial Uses, of the receiving waterbodies in the GSD study area.

## 4.1 Sensitive Areas

Sensitive Areas are defined in the USEPA CSO Control Policy as:

- Outstanding National Resource Waters
- National Marine Sanctuaries
- Waters with threatened or endangered species or their designated critical habitat
- Primary contact recreation waters, such as bathing beaches
- Public drinking water intakes and their designated protection areas
- Shellfish beds

Beneficial Uses include those uses that meet the Sensitive Areas criteria listed above, and other uses such as secondary contact recreation, aesthetic enjoyment, fishing and state designations, that are not included in the Sensitive Area criteria.

GSD performed a complete and thorough evaluation of the waterbodies in its service area, beneficial uses and status relative to the Sensitive Area criteria and has determined that CSOs from GSD's sewer system do not discharge to any Sensitive Areas.

This evaluation has, in addition to the primary contact recreation waters identified as part of the Sensitive Area definition, identified other beneficial recreational uses to provide a more comprehensive understanding of the waterways and guide prioritization of alternatives. These beneficial uses include secondary contact and non-contact recreation such as boating, aesthetic enjoyment from parks and adjacent trails or pathways, and potential for fishing access.

Evaluation of threatened or endangered species is based on the federal designations, high quality natural habitats areas are identified to provide a more comprehensive understanding of the waterways and guide prioritization of alternatives.

## 4.2 Special Designations

Sensitive Areas include "Special Designated" Outstanding National Resource Waters and National Marine Sanctuaries.

The study area does not include National Marine Sanctuaries (NOAA-NMSS 2018).

Outstanding State Resource Waters are listed for the State of Indiana in Title 327 of the Indiana Administrative Code Section 2-1.5-19. These waters include the Indiana portion of the open waters of Lake Michigan, waters in the Indiana Dunes National Lakeshore, the East Arm of the Little Calumet River and a portion of the Deep River upstream of the Little Calumet River.

The Division of Outdoor Recreation of the Indiana Department of Natural Resources (IDNR) lists rivers of particular environmental and aesthetic interest in the state of Indiana. Waterbodies on the Outstanding Rivers List for Indiana are identified based on 22 categories including Wild and Scenic River designations from the U. S. Congress and other state and local criteria. Two rivers, the Deep River and the East Arm of the Little Calumet River are included on this list. The Deep River, from one mile south of U. S Route 30 to the Little Calumet River was included due to the state-designated canoe and boating route and its outstanding recreational importance. The Little Calumet East Fork (East Arm), from County Route 600 E to State Route 249 in Porter County, was identified based on its status as a state fishing river, a state designated canoe trail and a salmonid stream. These river segments are shown on **Figure 4-1**. Both designated river reaches are upstream tributaries to the Little Calumet River and the GSD CSO locations.

## 4.3 Aquatic Habitats

This section reviews information on aquatic habitats, including information on waters with federally listed threatened or endangered species or their designated critical habitat and the presence of shellfish beds.

Information on endangered, threatened or rare species in the Little Calumet/Portage-Burns Waterway, the Grand Calumet and Lake Michigan was requested from the Indiana Natural Heritage Data Center (INHDC 2018a, 2018b, 2018c). Data was provided for Lake Michigan, the Little Calumet River, the Grand Calumet River and adjacent areas (see **Appendix 4-1**). No federal endangered species were identified in the area. One federal threatened species, the Dune Thistle (*Crisium pitcher)* was identified at the Indiana National Lakeshore, but this is not an aquatic species of plant life.

No mollusk species were listed; no shellfish beds are known to be present. The projects in the waterways to address mollusk species habitat were not identified in IDNR documents related to freshwater mussels (IDNR 2016).

Within the Grand Calumet River, several locations, shown on **Figure 4-1**, were identified by the Indiana Natural Heritage Data Center as “high quality natural communities” including marsh and sedge meadow area the Dupont Natural Area, in East Chicago and wet prairie in the Seidner Dune and Swale Nature Preserve.

The Dupont Natural Area is a 172-acre undeveloped portion of the former Dupont manufacturing facility located north of the Grand Calumet River, west of Cline Avenue and south of Gary Road. The IDNR holds a conservation easement on this portion of the Dupont property and the habitat is managed by The Nature Conservancy (Parsons 2013)

Seidner Dune and Swale Nature Preserve is a 42-acre site owned the Shirley Heinze Land Trust in Gary, Indiana (IDNR 2018c). It is located on the Grand Calumet River, north of I-90 and east of

Kennedy Ave. It is an example of dune and swale habitat and also contains wetlands, oak savanna and floodplain marsh habitat

Pine Station Nature Preserve includes a small portion of the Grand Calumet River. The preserve is north of I-90 and east of North Clark Road. 258 acres It is bounded by train tracks on the north, east and southwest. Owned by IDNR, it is an example of a dune and swale habitat. Restoration activities are planned for on-site ponds and wetlands and will restore habitat (Wodrich 2017).

## 4.4 Water Intakes

Information for Sensitive Areas related to public drinking water intakes and their designated protection areas was obtained from the IDNR. Significant Water Withdrawal Facility Data from the IDNR (IDNR, 2017) was used to identify surface water intakes for public water supplies. Facilities in this database can withdraw more than 100,000 gallons of water per day. A total of 9 water intakes at 5 locations were identified within the study area of Lake Michigan. Public water supply intakes were identified for 3 entities: the East Chicago Water Department, the Indiana-America Water Company, Inc., and Hammond Water Works. Intakes were not identified on the Little Calumet River or Grand Calumet River.

## 4.5 Recreational Activities

In addition to the primary contact recreation waters identified as part of the Sensitive Area definition (i.e. bathing beaches), GSD identified other beneficial recreational uses to provide a more comprehensive understanding of the waterways and guide prioritization of alternatives. These beneficial uses included secondary contact and non-contact recreation such as boating, aesthetic enjoyment from parks and adjacent trails or pathways, and potential for fishing access.

Recreational activities on and adjacent to the Little Calumet River, Grand Calumet River and Lake Michigan shoreline (from Calumet Park on the west and Trail Creek on the east) include walking, biking, hiking, boating, and fishing. The study area encompasses the Indiana Dunes National Park Lakeshore in addition to numerous state and local parks and beaches as well as several marinas and boat ramps providing boat access. This section is extensive and demonstrates the breadth of recreational opportunities in and along the waterways. In depth research was undertaken to include all available information at the time of this report, though it is possible that some recreational uses or future plans are not known at this time. However, the documented uses in this report demonstrate that recreational uses exist or are planned for the entire length of the waterways and for most of the shoreline and waters of Lake Michigan and illustrate the importance of these water resources for the state of Indiana.

Recreational activities are grouped according to level of water contact. These include beaches (primary, or full-body, contact recreation), boating and marinas (secondary contact), trails and parks (aesthetic enjoyment) and fishing (fish consumption).

The region has extensive existing recreational opportunities both in and around the waterbodies of interest. Data sources discussed above were used to identify and spatially locate recreational facilities. These recreational facilities include:

- Swimming beaches;

- Water access including marinas, boat ramps, informal access points, fishing and water trails;
- Parks and biking/walking trails near water bodies.

Recreational data within the entire watershed was obtained by conducting an extensive and thorough review of available information including mapping and reports; however, information is only tabulated for locations in, adjacent to, or within 100 feet of the Little Calumet River, Grand Calumet River, and Lake Michigan. Trails were identified which provide access to the waterbodies along their route either by running adjacent to the water or by crossing water bodies.

### 4.5.1 Data Sources

In order to identify existing and future recreational activities in the study area, reports and data from regional and local planning agencies, recreation departments, park management agencies and non-governmental organizations were reviewed. Information was obtained both through exploring websites and direct communications with agencies as needed. Details on data gathering activities, agencies contacted, and information obtained are documented **Appendix 1-3**. Summaries of the primary sources of information related to recreational activities are below.

The Indiana Department of Natural Resources (DNR), Division of Outdoor Recreation has compiled recreation data including location, type and use information on parks, trails, fishing and water access points. This data set was updated in 2018 by the Division of Nature Preserves (INHDC 2018d) except for trails which was updated by the Division of Outdoor Recreation in 2017 (IDNR-DOR 2018) and is available through the DNR website or as a spatial data set which can be accessed through the state of Indiana GIS website or IndianaMap. Data obtained directly from the DNR was compared against a variety of sources listed below prior to being used for creating spatial maps and figures included in this section.

- Beach names and locations were obtained through the Indiana beach monitoring database (IDEM-BeachGuard System 2018).
- Indiana Dunes National Park Lakeshore website and maps were reviewed for information on recreational opportunities within the park and along the Lake Michigan shoreline including trails and beach access locations (NPS 2018).
- Aerial imagery (Google Earth Pro, accessed 2018) and Google Maps (Google, accessed 2018) were used to confirm marina and beach locations and to verify the list of locations available from the IDNR.
- Information on public access points were obtained from stream surveys conducted as part of the Stream Reach Characterization and Evaluation Reports (SRCER) for the Grand Calumet River (Greeley and Hansen, 2000) and the Little Calumet River (Greeley and Hansen, 2002). Surveys were used in conjunction with other data on fishing and boat access locations to identify stream access points. The SRCER for the Grand Calumet River was prepared in September 2000 and subsequently revised in October 2000 and June 2001. The Little Calumet River SRCER was published in October 2002. River use data from these activities is provided in **Appendix 4-2**.

- The Greenways and Blueways map developed by the Northwest Indiana Regional Planning Commission (NIRPC 2016) includes non-motorized trails and routes in Lake, Porter, and LaPorte counties. This map was updated in 2016. The NIRPC Full Commissions adopted Greenways + Blueways 2020 plan at their board meeting on March 15, 2018. The 2020 plan combines conservation, transportation and recreation. Spatial data layers depicting the trails shown on this map were obtained directly from the NIRPC.
- Trail information obtained from IDNR was compared to available data by reviewing websites for organizations that have compiled trail information or that exist to support development and maintenance of specific trail corridors or recreational and educational opportunities. These websites are included in the reference section (NPS 2016).
- Additional information on existing and proposed recreation uses was obtained directly from municipal sources including websites and direct requests via letter. Documentation of correspondence and data received is presented in **Section 1** and **Appendix 1-2**.

### 4.5.2 Swimming Beaches

Beaches were identified using IDNR spatial data and visual inspection of aerial photos. Parks adjacent to the waterbodies that have beach or swimming facilities located on lakes or ponds which are not connected to the rivers were not included. Beaches are shown on **Figure 4-2** as linear features and listed in **Table 4-1** below. The ID used for tracking purposes in the EPA beach water quality databases is included for reference. The swimming beaches identified are located on the shoreline of Lake Michigan. Beaches are present along the entire length of the Indiana Dunes National Park. Town beaches were identified from the mouth of the Burns Ditch along the shoreline west to Illinois, except for areas developed for industrial purposes such as the US Steel site in Gary and the Indiana Harbor Canal area. Beaches and swimming areas were not identified in the Grand Calumet River, the Little Calumet River or the Portage-Burns Waterway.

**Table 4-1. Swimming Beaches**

| Name | Managed By | City | EPA Beach ID |
|---|---|---|---|
| Buffington Harbor Beach | City of East Chicago | East Chicago, IN | IN708061 |
| Calumet Park (South Beach) | Chicago Park District | Chicago, IL | IL376700 |
| Central Avenue Beach | National Parks Service | Michigan City, IN | IN409479 |
| Drexwood Beach | Town of Beverly Shores | Beverly Shores, IN | IN641681 |
| Dunbar Beach | National Parks Service | Beverly Shores, IN<br>Indiana Dunes National Lakeshore | IN470039 |
| Dune Acres Beach | National Parks Service | Dune Acres, IN<br>Indiana Dunes National Lakeshore | IN467080 |
| Hammond Marina Lake Front Park (East and West Beaches) | Hammond Parks and Recreation | Hammond, IN | IN415822<br>IN050219 |
| Indiana Dunes State Park (East and West Beaches) | Indiana Department of Natural Resources | Chesterton, IN | IN768689<br>IN700064 |
| Jeorse Park (Beaches I and II) | City of East Chicago | East Chicago, IN | IN319633<br>IN971200 |

| Name | Managed By | City | EPA Beach ID |
|---|---|---|---|
| Kemil Beach | National Parks Service | Beverly Shores, IN | IN471672 |
| Lake View Beach | National Parks Service | Michigan City, IN<br>Indiana Dunes National Lakeshore | IN513118 |
| Lake Street Beach | Gary Parks and Recreation | Gary, IN | IN941586 |
| Marquette Park Beach | Gary Parks and Recreation | Gary, IN | IN924097 |
| Mount Baldy Beach | National Parks Service | Michigan City, IN | IN547226 |
| Munson Beach | private beach | Chicago, IL | IL717106 |
| Ogden Dunes Beach (West and East Beaches) | Town of Ogden | Ogden Dunes, IN | IN785671<br>IN801572 |
| Porter Beach | National Parks Service | Porter, IN<br>Indiana Dunes National Lakeshore | IN713599 |
| Portage Lakefront and Riverwalk Beach | National Parks Service | Portage, IN | |
| Shore Avenue Beach | Town of Beverly Shores | Beverly Shores, IN | IN521740 |
| Wells Street Beach | Gary Parks and Recreations | Gary, IN | IN248759 |
| West Beach | National Parks Service | Portage, IN | IN504180 |
| Whihala Beach County Park (East and West Beaches) | Lake County Parks and Recreation | Whiting, IN | IN701183<br>IN530290 |

### 4.5.3 Water Access and Fishing

Water access locations for boating (i.e. secondary contact recreation) were identified for both motorized and non-motorized craft. Water access locations include marinas, boat ramps and informal access locations which could be used for launching small boats. It was assumed that fishing could occur at locations with water access. Water access locations were identified through spatial data from IDNR, visual inspection of aerial photography and river surveys. Marinas, boat ramps and informal access points are listed in **Table 4-2** and shown on **Figure 4-3.** Reference numbers used on **Figure 4-3** are listed in the table with the corresponding feature.

Four marinas are located on the Lake Michigan shoreline between Calumet Park in Chicago, Illinois to Jeorse Park in East Chicago, Indiana. In addition, access is available for smaller craft at boat ramps in the numerous beaches and parks on the Lake Michigan shoreline.

Recreational marinas and formal boat ramps were not identified on the Grand Calumet River. Informal access points were noted at several locations including at 2$^{nd}$ and Polk Street, 2$^{nd}$ and Buchanan Street, and Waite Street. There is also an area where boats could be launched adjacent to Bridge Street. The Indiana Harbor Canal was not included in the evaluation as the boat traffic is primarily commercial and not associated with recreational use of the waterways.

Five marinas and a boat ramp were identified near the junction of the Little Calumet River and the East Arm of the Little Calumet River. These locations provide easy access for boaters to reach Lake Michigan. Further upstream, some private boats were noted in aerial images. Informal access points and boat ramps are present on the Little Calumet River west of the junction with Deep River and in the Deep River upstream of the Little Calumet River.

Recreational fishing in the waterbodies can occur from boats as well as shoreline locations. Shoreline fishing access points are located along all the major waterways. The IDNR provides information about public fishing, species and access points to waterways through their website. In addition to data from the DNR, stream surveys (SRCER) and aerial imagery were used to identify potential fishing access points including docks on the Little Calumet River west of the Deep River. It is assumed that fishing could occur at water access points.

The State of Indiana supports an urban fishing program called "Go Fish in the City". No urban fishing locations were identified along the waterbodies of interest (IDNR 2018a). There is one urban fishing location in the watershed at Robinson Lake in Hobart, Indiana. This lake is not directly connected to the Little Calumet River.

**Table 4-2. Marinas, Boat Ramps and Water Access Locations**

| Reference Number | Site | Access Type | City/Town | Adjacent Waterway |
|---|---|---|---|---|
| 1 | Chicago Coast Guard Station | Coast Guard Station | Chicago, IL | Lake Michigan |
| 2 | Calumet Yacht Club | Marina | Chicago, IL | Lake Michigan |
| 3 | Hammond Yacht Club | Marina/Boat Launch | Hammond, IN | Lake Michigan |
| 4 | Whihala Beach | Boat Launch | Whiting, IN | Lake Michigan |
| 5 | Indiana Harbor Yacht Club | Marina/Boat Launch | East Chicago, IN | Lake Michigan |
| 6 | East Chicago Marina | Marina | East Chicago, IN | Lake Michigan |
| 7 | Marquette Park | Boat Launch | Gary, IN | Lake Michigan |
| 8 | Marquette Park | Boat Launch | Gary, IN | Lake Michigan |
| 9 | Portage Lakefront and Riverwalk | Boat Launch | Portage, IN | Lake Michigan |
| 10 | Marquette Yacht Club | Marina | Portage, IN | Little Calumet River |
| 11 | Marina Shores Dune Harbor | Marina | Portage, IN | Little Calumet River |
| 12 | Portage Public Marina | Marina | Portage, IN | Little Calumet River |
| 13 | Portage/Ogden Dunes | Boat Launch | Portage, IN | Little Calumet River |
| 14 | Doynes Marina Inc | Marina | Portage, IN | Little Calumet River |
| 15 | South Shore Marina | Marina | Portage, IN | Little Calumet River |
| 16 | Porter Beach | Boat Launch | Portage, IN | Lake Michigan |
| 17 | Kemil Beach | Boat Launch | Beverly Shores, IN | Lake Michigan |
| 18 | Dunbar Beach | Boat Launch | Beverly Shores, IN | Lake Michigan |
| 19 | Lake View Beach | Boat Launch | Beverly Shores, IN | Lake Michigan |
| 20 | Cline Ave | Other Water Access Point[(2)] | Gary, IN | Grand Calumet River |
| 21 | North End Waite Street | Other Water Access Point[(2)] | Gary, IN | Grand Calumet River |
| 22 | Bridge St | Boat Launch[(2)] | Gary, IN | Grand Calumet River |
| 23 | 2nd and Buchanan St | Other Water Access Point[(2)] | Gary, IN | Grand Calumet River |
| 24 | 2nd & Polk St | Other Water Access Point[(2)] | Gary, IN | Grand Calumet River |
| 25 | Indiana Welcome Center | Boat Launch | Hammond, IN | Little Calumet River |

| Reference Number | Site | Access Type | City/Town | Adjacent Waterway |
|---|---|---|---|---|
| 26 | George Carlson Oxbow Park | Other Water Access Point(1) | Hammond, IN | Little Calumet River |
| 27 | Liable Rd | Other Water Access Point(1) | Highland, IN | Little Calumet River |
| 28 | Colfax Bridge | Other Water Access Point(1) | Gary, IN | Little Calumet River |
| 29 | Calhoun St | Other Water Access Point(1) | Gary, IN | Little Calumet River |
| 30 | Wooden Dock | Other Water Access Point(1) | Gary, IN | Little Calumet River |
| 31 | Grant St | Other Water Access Point(1) | Gary, IN | Little Calumet River |
| 32 | Harrison St | Boat Launch(1) | Gary, IN | Little Calumet River |
| 33 | Fishing Dock | Other Water Access Point(1) | Gary, IN | Little Calumet River |
| 34 | Culvert West of MLK Dr | Other Water Access Point(1) | Gary, IN | Little Calumet River |
| 35 | Liverpool Road | Boat Launch | Lake Station, IN | Deep River |
| 36 | Bicentennial Park | Boat Launch | Lake Station, IN | Deep River |
| 37 | Riverview Park | Boat Launch | Lake Station, IN | Deep River |

Notes:

(1) Information from Little Calumet River SRCER

(2) Information from GSD Draft CSO Long-Term Control Plan, 2014.

In addition to direct access points, two water trails were identified for non-motorized boating activities, i.e. canoeing and kayaking. Water trails, or "blueways," are established specifically for recreation and have access points and associated shore facilities for recreation such as picnicking or camping. The Lake Michigan National Recreation Trail runs along the shoreline of Lake Michigan according with the National Recreation Trail Database (NRT 2018). When completed it will cover 1638 miles of Lake Michigan shorelines across four states of Illinois, Indiana, Michigan and Wisconsin. The Deep River Water Trail runs from Deep River County Park, one mile south of U. S. Route 30 in Hobart, Indiana to the confluence with the Little Calumet River and Burns Ditch (IDEM 2018b). A water trail is also present on the Little Calumet River between Kennedy Avenue in Hammond and Harrison Street in Gary (Greenways & Blueways 2016). These trails are shown on **Figure 4-3**.

### 4.5.4 Parks and Trails

The study area has extensive hiking, walking and biking trails. Many of these trails follow former railroad beds, are located within parks and preserves or run parallel to water bodies. Information on trails was drawn from IDNR spatial data, NIPRC spatial data, town data and local trail websites. **Table 4-3** lists the trails identified as part of this study. These trails are also shown on **Figure 4-4.** Of particular note are the Little Calumet River Levee Trail which provides access to the Little Calumet River west of the Deep River and the Grand Calumet River Trail through Gary. When fully complete, both trails will provide access to these important resources for recreation.

**Table 4-3. Biking, Walking and Hiking Trails**

| Name | Length (miles) | Type | Usage | Managed By | Existing/Proposed |
|---|---|---|---|---|---|
| Bailly/Chellberg Area Trails | 2.1 | Park/ Forest | Multi-Use | Indiana Dunes National Lakeshore | Existing |
| Cowles Bog Trail | 4. 6 | Park/ Forest | Hiking | Indiana Dunes National Lakeshore | Existing/ Proposed |
| Dune Succession Trail | 1 | Park/ Forest | Hiking | Indiana Dunes National Lakeshore | Existing |
| Erie Lackawanna Trail | 17 | Urban | Multi-Use | Highland Parks and Recreation Department, North Township Parks and Recreation Department | Existing |
| Grand Calumet River Trail | 12. 5 | Urban | Multi-Use | City of Gary | Existing/ Proposed |
| Indiana Dunes State Park Trails | 10. 7 | Park/ Forest | Hiking | Indiana Dunes National Lakeshore | Existing |
| Iron Horse Heritage Trail | 2.4 | Urban | Multi-Use | Portage Parks Department | Proposed |
| Little Calumet River Levee Trail | 15 | Riparian | Multi-Use | Little Calumet River Basin Development Commission | Existing/ Proposed |
| Marquette Greenway - Gary Green Link | 1 | Urban | Multi-Use | Gary Planning Commission | Existing |
| Marquette Greenway - Hammond Marina State Link | 1. 6 | Urban | Multi-Use | Town of Whiting | Proposed |
| Marquette Greenway - National Lakeshore Link | 8 | Urban | Multi-Use | Indiana Dunes National Lakeshore | Existing/ Proposed |
| Marquette Park Trails | 4.1 | Park/ Forest | Multi-Use | City of Gary | Existing |
| Miller Woods Trail | 2.3 | Park/ Forest | Multi-Use | Indiana Dunes National Lakeshore | Existing |
| Monon Trail | 1. 58 | Urban | Multi-Use | Munster Park and Recreation Department | Existing |
| Portage Lakefront Park Trail | 1.32 | Park/ Forest | Multi-Use | Indiana Dunes National Lakeshore | Existing |
| West Beach Trail | 1. 4 | Park/ Forest | Hiking | Indiana Dunes National Lakeshore | Existing |
| Whihala Beach Trail | 1. 2 | Park/ Forest | Multi-Use | Town of Whiting | Existing |
| Wicker Park Loop Trail | 2. 15 | Park/ Forest | Multi-Use | North Township Parks and Recreation Department | Existing |

Numerous parks and nature preserves are located within the study area including federally owned lands, state owned parks, local municipalities and private organizations. Beaches or direct water access associated with these parks are identified in the sections above. Parks which do not provide direct water access are also included to illustrate the variety of recreation opportunities that make use of both direct and aesthetic aspects of the waterways. Identified parks and nature preserves including the park name, adjacent body of water and location are included in **Table 4-4** and shown on **Figure 4-4.**

**Table 4-4. Table of Parks and Nature Preserves**

| Name | Body of Water | City |
|---|---|---|
| Ambridge Mann Park | Grand Calumet River | Gary, IL |
| Calumet Park | Lake Michigan | Chicago, IL |
| Carlson-Oxbow Park | Little Calumet River | Hammond, IN |
| Gleason Park | Little Calumet River | Gary, IN |
| Homestead Park | Little Calumet River | Highland, IN |
| Indiana Dunes State Park | Lake Michigan | Chesterton, IN |
| Jeorse Park | Lake Michigan | East Chicago, IN |
| Lake Etta County Park | Little Calumet River | Gary, IN |
| Marquette Park | Lake Michigan | Gary, IN |
| Portage Lakefront Park and Riverwalk | Lake Michigan and Little Calumet River | Portage, IN |
| Pine Station Nature Preserve | Grand Calumet River | Gary, IN |
| Seidner Dune and Swale Nature Preserve | Grand Calumet River | Lake Station |
| Whiting Lakefront Park | Lake Michigan | Whiting, IN |

## 4.6 Sensitive Area Identification

Based on the USEPA CSO Control Policy (USEPA 1994) and the USEPA CSO LTCP guidance (USEPA 1995) sensitive areas are identified based on the inherent characteristics, national designations and beneficial uses of the receiving waters. Sensitive areas are defined in the above-referenced USEPA documents as:

- Outstanding National Resource Waters, (referred to in Indiana as Outstanding State Resource Waters)
- National Marine Sanctuaries
- Waters with threatened or endangered species or their designated critical habitat
- Primary contact recreation waters, such as bathing beaches
- Public drinking water intakes and their designated protection areas
- Shellfish beds

The extensive information about the subject waterbodies described above was reviewed to identify any Sensitive Areas. The Grand Calumet and the Little Calumet River are tributaries to Lake Michigan. Lake Michigan meets some Sensitive Area criteria. The open waters of Lake Michigan are designated as an Outstanding National Resource Water. In addition, Lake Michigan contains swimming areas (primary contact recreation) associated with beaches located on the shoreline of Lake Michigan and public drinking water supply intakes.

The locations of the Sensitive Areas and CSO outfalls in the GSD sewer system are shown on **Figure 4-5**. Based on the Sensitive Area criteria above, CSOs from the Gary Sanitary District do not discharge to any Sensitive Areas. The Sensitive Area criteria for the study area waters are summarized in **Table 4-5**.

Beach areas are identified with lines along the shoreline. Water intake locations in Lake Michigan are shown as point features. Potential impacts to these Sensitive Areas based on analysis of CSO discharges including water quality modeling is discussed in **Section 6**.

**Table 4-5. Summary of Sensitive Area Criteria**

| Sensitive Area Criteria | Little Calumet River | Grand Calumet River | Lake Michigan |
|---|---|---|---|
| Outstanding National Resource Waters | None | None | Open waters of Lake Michigan |
| National Marine Sanctuaries | None | None | None |
| Threatened or Endangered species | None | None | None |
| Primary Contact Recreation | None | None | Shoreline beaches |
| Public Drinking Water Intakes | None | None | Multiple intakes |
| Shellfish Beds | None | None | None |

GSD identified other beneficial recreational uses in order to provide a more comprehensive understanding of the waterways and guide prioritization of alternatives. These beneficial uses included secondary contact and non-contact recreation such as boating, aesthetic enjoyment from parks and adjacent trails or pathways, and potential for fishing access. These beneficial uses are summarized in **Table 4-6**.

**Table 4-6. Summary of Additional Uses to Guide LTCP Prioritization**

| Beneficial Use | Little Calumet River | Grand Calumet River | Lake Michigan |
|---|---|---|---|
| Secondary Contact Recreation (boating) | Yes – water trails, marinas and boat ramps | Yes – boat ramps | Yes – water trails, marinas and boat ramps |
| Aesthetic Enjoyment (parks and trails) | Yes – multiple locations | Yes – multiple locations | Yes – multiple locations |
| Fishing Access | Yes – multiple locations | Potential – access exists, but signs warn of poor water quality | Yes – multiple locations and open waters |

# Section 5

# CSO Discharge Characteristics

GSD has maintained a computer model of its collection system for more than 20 years. This model was originally developed using the USEPA SWMM Version 4 software and has been regularly updated and calibrated. The model is currently maintained as a SWMM Version 5 model and the current version of this model has been used to determine the flows from GSD's combined sewer system to the receiving water bodies.

The collection system model was calibrated to flow, depth, and velocity data collected during 2008 at 19 monitoring locations (see **Appendix 5-1**, Gary Model Calibration Report Volumes 1,2 and 3, June 2011, and USEPA Approval Letter and **Appendix 5-2** for the specific calibration plots). For the January 2014 Final Draft CSO Characterization Report the model was updated to reflect changes in system operations that have been implemented since 2008. The model was also modified to include controls on gate operation based on recorded gate operations on the main interceptor along the Grand Calumet River to allow for continuous simulation of a typical year. The updated model was used to simulate 2011 conditions and validated against flow data at the GSD WWTP. The validated model is the basis of the simulation of the baseline 2011 conditions using the typical year precipitation record (1986) and associated long-term average boundary conditions. **Appendix 5-3** presents the Typical Year Development and USEPA Approval, and **Appendix 5-4** presents the validated results.

Discrepancies between observed data at the CSOs and model-predicted results can be attributed to field conditions that make metering discharges problematic. Many of the locations have double-weirs, long uneven weirs, and probes. The collection system model will be updated to 2018 (current) conditions prior to the start of the alternative analysis for the CSO LTCP. This step will reflect the changes in the collection system and operation of the WWTP that have occurred since 2013. For this report and findings, the validated 2011 model will be used to represent baseline 2011 conditions.

## 5.1 Collection System Model Modifications

The calibrated model presented in the June 2011 GSD Model Calibration Report has been updated on several occasions recently to better represent current conditions. The four updates completed earlier in 2013 to support the Interim CSO Characterization Report (July 2013) are summarized in **Table 5-1** and described in greater detail in this section.

The collection system model is used to develop CSO loads input to the receiving water models, and the most recent updates to the collection system model were performed as part of the process of re-validating the receiving water models of the Little Calumet and Grand Calumet Rivers using the most recent (August through October 2013) water quality monitoring data. These updates to the collection system model are described in **Section 5.5** below.

**Table 5-1. Collection System Model Updates**

| Update | Description | Need |
|---|---|---|
| WWTP rating curve adjustment | Dry weather water surface elevation in main interceptor directly upstream of WWTP lowered one foot from 2008 calibration. | WWTP operation has improved since 2008. Current operation does not surcharge main interceptor during dry weather flow, adding storage capacity at beginning of storms. |
| Gate operation control rules | Gate operation control rules were developed from 2011 gate operations, revising the gate operation observed in 2008. | Gate operation is controlled by WWTP operators. While actual gate position data is available for recent years, it was necessary to develop control rules to mimic current operation for LTCP baseline simulation. Control rules are calibrated to 2011 observations as shown in **Appendix 5-1**. |
| Recession limb infiltration unit hydrographs (RTKs) | Seasonal unit hydrographs added throughout collection system. Parameters calibrated to 2011 observations. | 2008 model used external time series to fully represent storm hydrograph recession limbs. 2011 model represents recession exclusively as function of precipitation. |
| Seasonal ground water infiltration (GWI) baseflow time series | Seasonal-scale GWI time series used in 2008 calibration modified to match baseflow component of 2011 observed flow. GWI is defined as long-term baseflow that is not rainfall dependent. | Long-term seasonal time series of GWI simulates baseflow in years without observed flows, including the typical year (1986). Long-term seasonal time series developed during 2008 calibration was modified during 2011 verification. |

During the 2008 calibration period the water surface elevation in the main interceptor along the Grand Calumet River was observed to be maintained at or above the crown of the 84-inch circular conduit during dry weather flow. GSD has greatly reduced the HGL in the 84-inch interceptor by minimizing the WWTP raw sewage pumping wet well level to the least amount without inducing pump cavitation. The pump curve used in the collection system model to represent the relationship between the WWTP influent and depth in the interceptor was adjusted to reflect this operational change.

During calibration, the collection system model used time series of archived gate positions during the 2008 calibration period to simulate gate operation at the seven regulators connected to the main interceptor along the Grand Calumet River. As explained the 2011 Model Calibration Report, the 2008 gate position data was adjusted to reflect actual gate positions. To prepare the model for typical year simulation, real-time control rules were developed from archived gate position data taken from 2011. Plots of observed gate position and gate operation simulated using real-time control rules are shown in **Appendix 5-4** Under the current operation, gate positions do not necessarily maintain a consistent relationship with flow at the WWTP; in 2011 during storms producing similar loadings, gates may have been closed in one storm and kept open in others. The control rules added to the updated model reflect observed in the archived gate position data for 2011. **Table 5-2** summarizes the sequence of simulations used to create the gate operation control rules used in the baseline model.

**Table 5-2. Collection System Model Sequence of Simulations**

| Simulation | Report | Precipitation Input | Gate Operations |
|---|---|---|---|
| Calibration | Calibration Report | 2008 observed | 2008 observed |
| Validation | CSO Characterization and Sensitive Areas Report | 2011 observed | 2011 observed |
| Control Rule Validation | CSO Characterization and Sensitive Areas Report | 2011 observed | Control rules mimicking 2011 operating procedures |
| Baseline | CSO Characterization and Sensitive Areas Report | Typical Year (1986) | Control rules mimicking 2011 operating procedures |
| 2013 Water Quality Sampling Validation | CSO Characterization and Sensitive Areas Report | 2013 observed | Control rules mimicking 2011 operating procedures |

In order to perform model verification using 2011 flow data, the seasonal groundwater infiltration (GWI) was adjusted to match the baseflow observed at the WWTP during 2011. The base sanitary flow (BSF) calculated from the 2008 calibration data was unchanged. For the validation and typical year simulation it was deemed necessary to represent infiltration observed in the receding limb of most storm hydrographs with seasonal RTK unit hydrographs distributed throughout the collection system. The satellite community flows were not assigned RTKs because their associated storm responses already accurately represented the recession limb. Only the medium and long-term unit hydrographs were added. The short-term hydrology is still simulated using the SWMM catchments developed from the 2008 calibration data. The RTKs are applied to all rainfall with seasonally observed variation in RTK parameters. The medium and long term seasonal unit hydrographs are presented in **Table 5-3**.

**Table 5-3. Seasonal RTK Unit Hydrograph Parameters**

| Response | R | T | K |
|---|---|---|---|
| *January to March* | | | |
| **Short** | NA | NA | NA |
| **Medium** | 0.05 | 10 | 5 |
| **Long** | 0.08 | 55 | 3 |
| *April and May* | | | |
| **Short** | NA | NA | NA |
| **Medium** | 0.05 | 15 | 5 |
| **Long** | 0.15 | 60 | 3 |
| *June and July* | | | |
| **Short** | NA | NA | NA |
| **Medium** | 0.05 | 15 | 5 |
| **Long** | 0.12 | 60 | 3 |

| Response | R | T | K |
|---|---|---|---|
| *August and September* | | | |
| **Short** | NA | NA | NA |
| **Medium** | 0.05 | 15 | 5 |
| **Long** | 0.15 | 60 | 3 |
| *October to December* | | | |
| **Short** | NA | NA | NA |
| **Medium** | 0.05 | 15 | 4 |
| **Long** | 0.05 | 55 | 3 |

## 5.2 Collection System Model Validation (2011 Conditions)

The updated model was used to simulate the response of the GSD system to the 2011 precipitation data from six rain gages maintained by the GSD at the 15th Avenue and Clay Street, 27th Avenue and Chase Street, and 42nd Avenue and Johnson Pump Stations, and the Chase Street and Colfax Street Regulator Structures. The simulated flow at the WWTP was compared with 2-minute flow observations at the WWTP. Plots showing long-term observed and simulated flow at the WWTP for 2011 are presented in **Appendix 5-4**.

Five of the larger storm events for 2011 were selected to compare observed and simulated flow. A calibration plot of each event is shown in **Appendix 5-3**. The total volume and the peak flow rates were calculated and compared for each event, as shown in **Table 5-4**.

**Table 5-4. Validation Storm Event Statistics**

| Storm | Start | End | Total Depth (in.) | Peak Intensity (in./hr) | Event Volume (MG) | | Peak Flow Rate (MGD) | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Model | Observed | Model | Observed |
| March 2011 | 3/4/2011 | 3/12/2011 | 0.51 | 0.37 | 422 | 434 | 99 | 92 |
| May 2011 | 5/24/2011 | 6/8/2011 | 2.54 | 0.51 | 1,055 | 1,049 | 122 | 119 |
| June 2011 | 6/8/2011 | 6/22/2011 | 1.75 | 0.54 | 954 | 1,018 | 127 | 129 |
| October 2011 | 10/13/2011 | 10/16/2011 | 1.17 | 0.73 | 205 | 159 | 131 | 132 |
| December 2011 | 12/14/2011 | 12/18/2011 | 1.46 | 0.31 | 304 | 300 | 114 | 134 |

The validated collection system model adequately simulates the wet weather flows observed at the WWTP in 2011 using appropriately modified seasonal GWI loading, RTK unit hydrographs to represent infiltration, real-time controls on gate operation, and an adjustment made to the water surface elevation control in the main interceptor, based on actual observations. This validated 2011 simulation is the basis for the typical year simulation described in the next section.

## 5.3 Baseline CSO Statistics

Precipitation from the typical year, as described in the 2012 Final Typical Year Determination memorandum included in **Appendix 5-3**, was used for simulation of the CSO baseline conditions. The USEPA-approved typical year is the 1986 hourly precipitation from South Bend, Indiana (COOP ID# 128187). The validated collection system model, including the updates to represent the current gate and WWTP operation, was simulated with this precipitation time series to produce baseline CSO statistics and percent capture for average annual (typical year) wet weather flow.

**Table 5-5** presents the average annual total volume and total duration of discharge for each CSO outfall in the GSD collection system. There are seven regulator structures along the Grand Calumet River and four along the Little Calumet River. The outfall at regulator at CSO 014 to the Little Calumet River at 25th Avenue and Wisconsin Street has been plugged and is no longer in service. The number of discrete events in the typical year is shown for each outfall.

The largest single source of CSO volume is CSO 006 (Rhode Island) on the Grand Calumet River at which the simulation shows 18 CSO events and a total of 169 MG during the typical year. While the CSO 008 (Polk) exhibits more simulated CSO events, each event was much smaller in volume. On the Little Calumet River, CSO 015 (32nd Broadway and Alley 1) contributes more CSO volume (42 MG) than any other outfall on that river. Although the volumes for each event are small relative to some of the other outfalls, CSO events occur at CSO 015 more often than at any other outfall in the entire system.

**Table 5-5. Baseline Average Annual CSO Flow Statistics**

| Receiving Water | Outfall | NPDES Outfall Number | Volume (MG) | Duration (hr) | Events/ Frequencies |
|---|---|---|---|---|---|
| East Branch Grand Calumet River | Rhode Island Street at East Interceptor | 006 | 168 | 122 | 18 |
| | Alley 9 at East Interceptor | 007 | 9.7 | 16 | 8 |
| | Polk Street at East Interceptor | 008 | 10 | 148 | 25 |
| | Pierce Street at East Interceptor | 009 | 25 | 75 | 6 |
| | Bridge Street at East Interceptor | 010 | 73 | 129 | 14 |
| | Chase Street at East Interceptor | 011 | 20 | 29 | 5 |
| | Colfax Street at West Interceptor | 012 | 23 | 167 | 15 |
| | **TOTAL** | | **328** | **167** | **25** |
| West Branch Little Calumet River | 15th Avenue and Elkhart Street | 004 | 16 | 863 | 12 |
| | 32nd Avenue and Broadway West | 005 | 3.7 | 36 | 5 |
| | 25th Avenue and Louisiana Street | 013 | 16 | 410 | 13 |
| | 32nd Broadway and Alley 1 East | 015 | 42 | 721 | 29 |
| | **TOTAL** | | **77** | **863** | **29** |
| System-wide | **TOTAL** | | **405** | **863** | **29** |

**Note**: CSO 014 - 25th Avenue and Wisconsin Street - is filled with concrete and not included in the table. It is located upstream of a pump station in Gary's Marshal Town subdivision. During an Army Corp levee project, the levee raised the water level to the point where water was backflowing into CSO 014 and flooding the upstream neighborhood. To prevent that from happening, GSD closed the CSO with concrete. However, GSD does not want to remove the CSO from its NDPES permit because that would require significant cost, effort, and coordination with the Army Corps. Additionally, GSD would like to keep the CSO in case of emergency. Therefore, CSO 014 remains in GSD's NPDES permit and it will be evaluated as part of the alternative analysis.

The estimated mean concentrations from CSO discharges of key pollutants of concern are presented in **Table 5-6**. The pollutants included are: *E. coli*, chemical biochemical oxygen demand (CBOD), TSS and total phosphorus. The type of mean calculated for each pollutant, either geometric and arithmetic, are noted in **Table 5-6**.

**Table 5-7** presents the estimated annual pollutant loads from each CSO based on the annual volumes from **Table 5-5** and the mean concentrations from **Table 5-6**.

GSD has installed monitoring equipment at each CSO outfall and reports monthly the estimated CSO flow to IDEM calculated from the monitoring data. It most cases, flow depth over a weir is monitored and the CSO flow is calculated using a weir equation. **Table 5-8** contains the CSO discharge frequency and volumes for the past 5 years based on the monitoring data and calculated CSO flow.

**Table 5-6. Mean Concentrations for CSO Discharges**

| Pollutant | CSO Mean Concentration | Units | Notes |
|---|---|---|---|
| *E. coli* Bacteria | $2.20 \times 10^5$ | cfu / 100 mL | Geometric mean of CSO sample data |
| CBOD | 60.5 | mg/L | Arithmetic mean of CSO sample data |
| TSS | 160 | mg/L | Arithmetic mean of CSO sample data |
| Total Phosphorus | 1.06 | mg/L | Arithmetic mean of CSO sample data |

**Table 5-7. Estimated Annual CSO Pollutant Load**

| River | Outfall | NPDES CSO No. | Volume (MG) | E. coli counts | CBOD lbs | TSS lbs | Total P lbs |
|---|---|---|---|---|---|---|---|
| Grand Calumet | Rhode Island Street at East Interceptor | 6 | 168 | 1.40E+15 | 84800 | 224000 | 1490 |
| | Alley 9 at East Interceptor | 7 | 9.7 | 8.08E+13 | 4900 | 13000 | 85.8 |
| | Polk Street at East Interceptor | 8 | 10 | 8.33E+13 | 5050 | 13400 | 88.5 |
| | Pierce Street at East Interceptor | 9 | 25 | 2.08E+14 | 12600 | 33400 | 221 |
| | Bridge Street at East Interceptor | 10 | 73 | 6.08E+14 | 36900 | 97500 | 646 |
| | Chase Street at East Interceptor | 11 | 20 | 1.67E+14 | 10100 | 26700 | 177 |
| | Colfax Street at West Interceptor | 12 | 23 | 1.92E+14 | 11600 | 30700 | 203 |
| | **TOTAL** | | **328** | **2.73E+15** | **166000** | **438000** | **2900** |
| Little Calumet | 15th Avenue and Elkhart Street | 4 | 16 | 1.33E+14 | 8080 | 21400 | 142 |
| | 32nd Avenue and Broadway West | 5 | 3.7 | 3.08E+13 | 1870 | 4940 | 32.7 |
| | 25th Avenue and Louisiana Street | 13 | 16 | 1.33E+14 | 8080 | 21400 | 142 |
| | 32nd Broadway and Alley 1 East | 15 | 42 | 3.50E+14 | 21200 | 56100 | 372 |
| | **TOTAL** | | **77** | **6.41E+14** | **38900** | **103000** | **681** |
| System-wide | **TOTAL** | | **405** | **3.37E+15** | **204000** | **541000** | **3580** |

**Table 5-8. Annual CSO Discharge Volumes**

| Year | Grand Calumet River CSO Volume (MG) | Little Calumet River CSO Volume (MG) | Total CSO Volume (MG) | CSO Frequency | Total Treated WWTP Effluent Volume (MG) | Total Precipitation (in.) |
|---|---|---|---|---|---|---|
| 2013 | 147 | 198 | 345 | 33 | 16,111 | 34.4 |
| 2014 | 650 | 607 | 1,257 | 50 | 19,222 | 51.7 |
| 2015 | 79 | 341 | 420 | 45 | 17,117 | 49.5 |
| 2016 | 4 | 402 | 406 | 52 | 18,309 | 46.0 |
| 2017 | 41 | 980 | 1,021 | 40 | 17,606 | 42.6 |

## 5.4 Percent Capture of Wet Weather Flow

The typical year baseline simulation results were evaluated for wet weather periods, defined as periods when the total system flows exceed 110% of average flow. Wet weather flow includes inflow and infiltration, the latter of which may last for more than a day after rainfall occurs. The 110% threshold is a reasonable statistical method to differentiate the wet weather impact to the system.

Under these criteria 168 of the total 365 days in the typical year are defined as wet days (days in which there are one or more periods that meet the above definition).

**Table 5-9** summarizes the mass balance of wet weather flow volume for the typical year estimated from the baseline simulation. The table accounts for the various sources and discharges of flow (including treated discharge, CSOs and flooding) during wet weather. Flooding is defined as flow lost from the system due to simulated surcharge conditions where the hydraulic grade line reaches the ground surface and discharges at the manhole (only a negligible volume, 0.09%, is lost due to flooding). As shown on **Table 5-9**, a significant fraction (97%) of the total system flow during wet weather is captured for treatment. Percent capture is defined as:

**[Percent Capture] = 1 - ([Total CSO] + [Flooding])/**

**([Total CSO] + [Flooding] + [WWTP] - [Satellite Flows])**

**Table 5-9. Mass Balance of Wet Weather Flow Volume for the Typical Year Baseline Simulation**

| Parameter | Model-Predicted Volume (MG) |
|---|---|
| Total System Inflow during Wet Weather | 10,940 |
| Total Satellite Flows during Wet Weather | 2,881 |
| Total CSOs to Receiving Waters | 405 |
| Total Flooding | 10 |
| WWTP treated Flows during wet weather | 10,492 |
| **% Capture** | **97.0%** |

The alternative analysis will look at both percent capture and annual overflow activations, as described in the 1994 CSO Control Policy, in evaluating the efficacy of CSO controls.

## 5.5 Collection System Model Validation (2013 Conditions)

The collection system model results were used to populate the receiving water quality models. As discussed in the next section of this report, the receiving water quality models have been validated with the recently collected 2013 water quality monitoring data. In order to accomplish this, it was therefore necessary to update and re-validate the collection system model for the 2013 conditions

The 2013 sampling period was simulated using 5-minute precipitation data collected from August 22, 2013 to November 1, 2013 from five rain gages maintained by GSD at 27th Avenue and Chase Street Pump Station, 33rd Avenue and Connecticut Street, 34th Avenue and Burr Street, Marquette Pump Station, and the Gary Landfill at 19th Avenue and Burr Street. The 2011 Baseline model described in **Section 5.2** was updated to approximate treatment plant operation from flow observed at the plant. The modeled GWI time series was also adjusted to match dry weather flows observed at the plant. The gate operation rules used were those derived from the 2011 Control Rule Validation described in **Section 5.1**.

The simulated flow at the WWTP was compared with two minute flow observations at the WWTP. A plot showing observed and simulated flow at the WWTP for the 2013 sampling period are presented in **Figure 5-1**. Validation plots for the two wet weather sampling events (September 18-20, 2013 and October 30-31, 2013) are shown in **Figures 5-2** and **5-3**. The total volume and the peak flow rates were calculated and compared for each event, as shown in **Table 5-10**.

**Table 5-10. Validation Storm Event Statistics**

| Storm | Start | End | Total Depth (in.) | Peak Intensity (in./hr) | Event Volume (MG) | | Peak Flow Rate (MGD) | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Model | Observed | Model | Observed |
| September 2013 | 9/18/2013 | 9/21/2013 | 3.79 | 0.12 | 262.3 | 218.5 | 143.8 | 143.8 |
| October 2013 | 10/30/2013 | 11/2/2013 | 2.36 | 0.06 | 192.7 | 173.4 | 133.8 | 140.7 |

The comparison of the modeled flow at the plant agrees reasonably closely with the observed data for the two 2013 events, and is similar to the previous (2011 condition) results. The validated collection system model is therefore found to adequately simulate the wet weather flows observed at the WWTP during the 2013 water quality sampling program. The Model Calibration Approval from IDEM and USEPA is included in **Appendix 5-1**.

# Section 6

# Impacts to Receiving Waters

The water quality conditions in the Little Calumet and Grand Calumet Rivers have been characterized using receiving water quality models of these water bodies. This characterization has been documented in the **Section 3** of this report including the 2013 water quality monitoring program for these water bodies completed by GSD (see **Appendix 3-2**). **Sections 6.1** and **6.2** are taken directly from the January 2014 Final Draft CSO Characterization Report (see **Appendix 1-1**) and describe the updates to the models and validation to the 2013 water quality sampling. **Section 6.3** describes the impact to Lake Michigan based on the receiving water quality model results.

Baseline model results from the validated receiving water quality monitoring are used to determine the impacts of CSOs to waterways. The baseline receiving water quality models extend from upstream of the GSD CSOs to the mouth of the Little Calumet and Grand Calumet Rivers at Lake Michigan. The models do not include the open waters of Lake Michigan or simulate the mixing of tributary inflows within Lake Michigan. Therefore, the farthest downstream segments in the receiving water models were used to assess impacts to Lake Michigan.

## 6.1 Receiving Water Quality Model Updates

Boundary conditions for the Receiving Water Quality Models for the Grand Calumet River and Little Calumet River are based on water surface elevation and discharge data from the typical year, 1986. Where data was not available for the typical year, or in the case of Lake Michigan not representative of average conditions, average long-term conditions ranging from 1994 to 2011 were used. Data series were selected based on availability and representativeness of both typical year and long-term conditions. In general, data is based on daily or monthly average records. The precipitation data for the typical year is from the South Bend, Indiana gage. Selection of this rainfall record is described in the Final Long-Term Control Plan Typical Year Determination and Baseline Conditions and Modeling Memorandum (CDM Smith 2012). This precipitation data, at 15-minute intervals, was used to calculate runoff (in the non-CSO areas) in the SWMM model. Flows from the WWTP and CSOs are from the collection system model described in **Section 5** of this report. Boundary conditions from other sources and *E. coli* loads developed as part of model calibration are discussed in this section.

### 6.1.1 Grand Calumet River Model Boundary Inputs

Boundary conditions for the Grand Calumet Receiving Water Quality Model include:

- Water surface elevations at Lake Michigan, based on the monthly average of water surface elevations at Indiana Harbor, USGS gage 4092750, over a 10-year period from October 1998 to October 2008. Monthly average water surface elevations ranged from 578.2 to 579.2 ft NGVD29. Data was not available for this gage during 1986.

- Baseflow for the Grand Calumet River was based on the average monthly baseflow at USGS gage 4092677, located at Industrial Highway. Baseflow was extracted from hourly data from October 1994 to September 2006. The average monthly WWTP outflow, as simulated by the collection system model during the typical year, was subtracted from the average monthly baseflow at USGS gage 4092677. This time series was then assigned to inflow locations in the Grand Calumet model using scale factors developed during model calibration. Baseflow is dominated by US Steel discharges and therefore primarily assigned at US Steel outfall locations. Details on baseflow assignment are provided in the Model Calibration Report, Volume 2: Little Calumet and Grand Calumet Receiving Water Models, approved by USEPA March 2011.

- A map showing the locations of the USGS gages mentioned above (4092750 and 4092677) is provided in **Appendix 6-1**. **Appendix 6-2** includes plots of the water surface elevation and baseflow time series used for the Grand Calumet River model.

## 6.1.2 Little Calumet River Model Boundary Inputs

Boundary conditions for the Little Calumet Receiving Water Quality Model include:

- Water surface elevations at Lake Michigan, based on the monthly average of Lake Michigan water surface elevations at Calumet Harbor, NOAA gage 9087044, over the most recent 10-year period from January 2002 to December 2011. Daily water surface elevations were available for 1986, but lake levels during this year are high compared to the long-term seasonal lake levels, and therefore do not represent typical conditions. Values were adjusted vertically from datum IGLD85 to NGVD29 feet. Monthly average water surface elevations ranged from 577.8 to 578.9 ft NGVD29.

- Water surface elevations at the western end of Little Calumet River, based on discharge during 1986 at USGS gage 05536195 in Munster, Indiana, located downstream (west) on the Little Calumet River near the Illinois border. Discharge was converted to water surface elevations using a stage-discharge relationship, which was developed based on water surface elevations observed at Burr Street, USGS gage 413339087223001, and discharge at gage 05536195. Average daily data from 2000 to 2008 was obtained to establish the stage-discharge relationship, which was used to convert 1986 daily average flows at gage 05536195 to daily stage values. These water surface elevation values at the western end of the model range from 588.9 ft to 593.4 ft NGVD29.

- Baseflow for the Little Calumet River, based on USGS gage 04095090 located at Burns Ditch in Portage, Indiana. Daily flow data is available from October 1994 to March 2012. A baseflow time series was extracted from the data using the sliding-interval method, as described in the Model Calibration Report (June 2011), and then average baseflow was calculated for each month. This time series was assigned to the model using the same locations and scaling factors used for the calibrated model.

- Baseflow and runoff for the Deep River at Lake George in Hobart, Indiana, extracted from USGS gage 04093000 using the sliding-interval method. Daily data for the selected typical year, 1986, was used.

- Baseflow and runoff for the East Branch of the Little Calumet River in Porter, Indiana, extracted from USGS gage 04094000 using the sliding-interval method. Daily data for the selected typical year, 1986, was used. This baseflow time series was also used for Willow Creek, which feeds into the Little Calumet River. The time series were scaled based on watershed area.

- For the Deep River, East Branch, and Willow Creek, catchments were added to the model to better represent runoff in time intervals less than one day. Runoff was calculated in SWMM for each tributary using a catchment representing the watershed. Catchment parameters were based on parameters developed for other catchments during model calibration. The catchment area and width were adjusted so that the total runoff volume matched the total volume of runoff calculated using the sliding-interval method.

The locations of the gages mentioned above are shown in **Appendix 6-1**. The stage-discharge relationship developed for the western model boundary condition and time series plots of water surface elevation and baseflow used in the Little Calumet River model are provided in **Appendix 6-2**.

### 6.1.3 Hydrology Changes

Information from the USACE on changes to river hydraulics, including those due to dredging and flood control, was reviewed. Based on the available information, no changes were made to the models.

### 6.1.4 *E. coli* Loading

*E. coli* loads for baseflow, runoff, CSO discharges, and WWTP effluent flows were developed as part of model calibration. The *E. coli* loads are summarized below.

*E. coli* loads for baseflow were based on calibration to geometric means of dry weather samples. In the Little Calumet River values of 100 CFU/100 mL were used for baseflow east of the Deep River, 300 CFU/100 mL for areas west of Deep River, 400 CFU/100 mL in the Deep River and 70 CFU/100 mL for the Little Calumet River East Branch. In the Grand Calumet River, values of 10 to 100 CFU/100 mL were used for baseflow.

*E. coli* loads for runoff were developed from the National Stormwater Quality Database and adjusted during calibration based on observed water quality values. A value of 4,000 CFU/100 mL was used for runoff in most of the modeled subcatchments for both the Grand Calumet and Little Calumet Rivers. A value of 1,000 CFU/100 mL was applied to runoff for the Little Calumet River East Branch based on observed values downstream at the confluence of the Little Calumet River and Burns Ditch.

The *E. coli* loads used for CSO discharge are the geometric mean of all locations and samples collected during the weather sampling events between 1999 and 2003 for each river. A value of 287,000 CFU/100 mL was used for CSOs discharging to the Little Calumet River and a value of 192,000 CFU/100 mL was used for the CSOs discharging to the Grand Calumet River. A value of 10 CFU/100 mL was assigned to the WWTP effluent flows.

## 6.2 Receiving Water Quality Model Validation (2013 Data)

The calibrated receiving water quality models for the Grand Calumet and Little Calumet Rivers were used to simulate 2013 flow and water quality conditions. Boundary conditions were updated using existing data and pollutant loads and flows from the calibrated collection system model (discussed in **Section 5**). Simulated *E. coli* concentrations in the rivers were compared to fixed day and wet weather sampling results from August through October 2013. Results indicate the previously calibrated models are valid for current conditions.

### 6.2.1 Boundary Conditions

Data for the boundary conditions, was updated with data from August 2013 through early November 2013. For the typical year simulation, monthly data was used for some boundary conditions in order to simulate representative average conditions. More frequent data was used for the 2013 simulations were applicable

For the 2013 model simulations, the following boundary conditions were used for the Grand Calumet River.

- Precipitation data was from the GSD Landfill gauge at 5-minute intervals.
- WWTP flows and loads and CSO flows and loads were from the collection system model at 5-minute intervals.
- Lake Michigan water surface elevations were daily average elevations from the Indiana Harbor Gauge (04092750).
- Baseflow was extracted from the daily average flows at the Industrial Highway Gage (04092677) using the sliding interval method as described in the Model Calibration Report (June 2011). Daily average WWTP flows were then subtracted and the resulting time series used to assign baseflow.

The following boundary conditions were used for the Little Calumet River.

- Precipitation data was from the GSD gauge at 27th Avenue and Chase Street at 5-minute intervals.
- WWTP flows and loads and CSO flows and loads were from the collection system model at 5-minute intervals.
- Lake Michigan water surface elevations were monthly average elevations from Calumet Harbor, NOAA gage 9087044.
- Water surface elevations at the western end the Little Calumet River were taken from the Highland, Indiana gauge 05536165 at 15-minute intervals. Stage data at this location is available starting in 2008.
- Baseflow was extracted from the daily average flows at the Burns Ditch (04095090, Deep River (04093000) and the East Branch of the Calumet River (04094000) gauges using the sliding-interval method as described in the Model Calibration Report (June 2011). The time series were used to assign baseflow in the model.

### 6.2.2 Validation to 2013 Water Quality Sampling

Simulated *E. coli* concentrations in the rivers were compared to fixed day and wet weather sampling results from August through October 2013. Results indicate the previously calibrated models are valid for current conditions.

**Figure 6-1** shows model simulated and observed *E. coli* values along the Grand Calumet and Little Calumet Rivers for the August 18, Fixed Day Sampling event. Model comparisons to observed data for the fixed day sampling events from August 18 through October 28, 2013 are included in **Appendix 6-3**. Results indicate that the model simulates *E. coli* concentrations along the river in a variety of conditions.

**Figures 6-2** and **6-3** show the model simulated and observed *E. coli* values in the Grand Calumet River during the wet weather events starting on September 18 and October 30, 2013. For some samples, the observed *E. coli* concentrations were recorded as > 2419 MPN / 100 mL. These values are indicated with a red triangle shown at 2419 MPN / 100 mL. Results validate the model simulation of *E. coli* in the Grand Calumet River.

**Figures 6-4 and 6-5** show the model simulated and observed *E. coli* values in the Little Calumet River during the wet weather events starting on September 18 and October 30, 2013. For some samples, the observed *E. coli* concentrations were recorded as > 2419 or > 2419 MPN / 100 mL. These values are indicated with a red triangle shown at the appropriate value. Results validate the model simulation of *E. coli* in the Little Calumet River.

## 6.3 Impact on Downstream Sensitive Areas (Lake Michigan)

Sensitive Areas, identified and discussed in **Section 4**, are not present in the Little Calumet and Grand Calumet Rivers. Lake Michigan open waters and shoreline meets some Sensitive Area criteria. Baseline model results from the validated receiving water quality modeling were used to determine the impacts of CSOs to Lake Michigan. The farthest downstream segments in the receiving water models was used to assess impacts, and the impact of CSOs on water quality conditions in the two rivers is described below.

Pollutants of concern for the Little Calumet and the Grand Calumet, which flow into Lake Michigan were identified in **Section 3.6**. For the Little Calumet River, pollutants of concern include *E. coli*, dissolved oxygen, total suspended solids, total phosphorus and PCBs. For the Grand Calumet River, pollutants of concern include *E. coli*, dissolved oxygen, total suspended solids, total phosphorus, ammonia, oil and grease, cyanide and PCBs. *E. coli* is widely associated with discharges from CSOs. Water quality analysis and TMDL studies for these waterbodies demonstrate that concerns for pollutants other than *E. coli* are primarily attributable to non-CSO sources including direct stormwater runoff and industrial contamination and will be addressed through TMDLs and environmental remediation. Therefore, this characterization report assesses the impact of *E. coli* from CSOs on Lake Michigan.

Model results for E. coli concentrations in Grand Calumet River and Little Calumet River were assessed for compliance with Indiana water quality standards for *E. coli* during the recreation season, which extends from April 1 to October 31. Water quality standards specify that concentrations of *E. coli* shall not exceed the following:

A) 125 CFU/100 mL for the geometric mean of not less than 5 samples equally spaced over a thirty day period, and
B) 235 CFU/100 mL in any one sample in a thirty-day period, except in cases where there are at least ten samples at a given site, up to ten percent of the samples may exceed 235 CFU/100 mL where the:
    1) *E. coli* exceedances are incidental and attributable solely to *E. coli* resulting from the discharge of treated wastewater from a wastewater treatment plant and
    2) Criterion in clause A is met

To assess water quality compliance, a hypothetical sample was taken each day during the month at noon, a reasonable and appropriate hypothetical sampling time. The results were compared to the two water quality standards for *E. coli*. Results are presented for model segments up to ¼ mile in length for the Grand Calumet River and the Little Calumet River. Note that since *E. coli* in the receiving water is from non-point sources and CSOs, the 235 CFU/100 mL standard is the maximum permissible value for any one sample and the clauses related to discharge from wastewater treatment plants do not apply. The sections below present the water quality compliance results for the typical year using calibrated baseflows and runoff concentration values. The sections below present the water quality compliance results for the typical year using calibrated baseflows and runoff concentration values. To examine the extent of the CSO contribution to nonattainment of the *E. coli* standard, results were evaluated for a scenario in which the baseflow and runoff values were improved to half the geomean standard (63 CFU/100 mL). This is a hypothetical condition, in which other sources of the *E. coli* were abated, to assess impacts which can be attributed to the CSO discharges. The concentration value of half the geomean standard was selected as a reasonable and appropriate approximation of improved non-point source concentration values. The LTCP will include analysis of additional alternatives including the elimination of all CSOs to the receiving waters.

## 6.3.1 Grand Calumet River Baseline Water Quality Compliance

### 6.3.1.1 Typical Year *E. coli* Standard Compliance

The geomean of the model-predicted *E. coli* concentrations in the Grand Calumet River for each month during the recreation season for the typical year are provided in **Table 6-1**. The results indicate that all segments of the Grand Calumet River are in compliance with the 125 CFU/100 mL geomean standard under baseline conditions (also see **Figure 6-6**). The computed geomeans, ranging from 11 to 48 CFU/100 mL, are well below the water quality standard in all river segments during the entire recreation season.

The percent of model-predicted *E. coli* concentrations (noon values) below 235 CFU/100 mL during each month of the recreation season in the Grand Calumet River is provided in **Table 6-2**. In this table, green shading shows the segments and months which are compliance (i.e. all model-predicated concentrations at noon for each day are below 235 CFU/100 mL). Segments and months not in compliance are shaded with red and the percent of model-predicted samples below 235 CFU/100 mL is listed. **Figure 6-7** shows the percent of values meeting the single sample 235 CFU/100 mL standard during the entire recreation season. The results indicate that *E. coli* counts meet the single sample standard in between 77% to 100% of the daily samples collected for each month during the recreation season under baseline conditions. Compliance with the single sample standard was highest during April and October and lowest during the month of July.

Model predicted compliance with both the geomean and single sample standard for the baseline conditions in the Grand Calumet River is summarized in **Table 6-3**. Based on the model predictions, non-compliance with the water quality standards is due to exceedances of the single sample standard.

**Figure 6-8** shows the frequency distribution of the model-predicted *E. coli* concentrations (noon values) during the recreation season at the outlet to Lake Michigan, as well as at the segments downstream of the WWTP and the CSO 006 (Rhode Island Street at East Interceptor) and CSO 007 (Alley 9 at East Interceptor) outfalls. The 235 CFU/100 mL single sample standard is shown as a bold black line and the orange, green and red lines indicates the concentration distribution at various points along the Grand Calumet River. Downstream of the WWTP (green line), the river is in compliance with the single standard of 235 CFU/100 mL standard for more than 95% of the samples. For the discharge from the Grand Calumet River into Lake Michigan (red line), the results indicate the water quality would be in compliance with the single sample 235 CFU/100 mL maximum standard for 90% of the recreation season.

### 6.3.1.2 Typical Year *E. coli* Standard Compliance with Improved Non-Point Sources

Model simulations were performed to evaluate the impact of improved conditions of the non-point sources. *E. coli* concentrations of baseflow and runoff were reduced to one half of the 125 CFU/100 mL geomean standard, or 63 CFU/100 mL. The baseline *E. coli* concentrations of the US Steel baseflow contributions are below 63 CFU/100 mL and were not further reduced for the model simulation. A constant flow of 20 cfs was applied in the model to represent inflows from the west where the Grand Calumet River discharges into Indiana Harbor Canal. The *E. coli* concentration for this inflow was reduced from 100 CFU/100 mL to 63 CFU/100 mL.

The geomean of the model-predicted *E. coli* concentrations with the improved non-point sources for the Grand Calumet River is provided in **Table 6-4**. All river segments remain in compliance with the geomean standard (see **Figure 6-9**), with geomeans ranging from 8 to 40 CFU/100 mL.

The percent of model-predicted *E. coli* concentrations (noon values) below the single sample standard of 235 CFU/100 mL with improved non-point sources is provided in **Table 6-5** for each month during the recreation season. **Figure 6-10** shows the percent of values meeting the single sample 235 CFU/100 mL standard during the entire recreation season. During the month of April, the *E. coli* counts are not predicted to exceed the single sample criteria. During the months of May to October, the model predicts that *E. coli* counts will meet the single sample criteria in between 80% and 100% of the daily samples collected for each month and model segment. Model predicted compliance with both the geomean and single sample standard for the improved NPS simulation in the Grand Calumet River is summarized in **Table 6-6**. Reducing the non-point source *E. coli* loads has a minimal impact on compliance with the water quality standards for the Grand Calumet River, since the majority of the baseflow, which is from US Steel, already has low *E. coli* values ranging from 10 to 30 CFU/100 mL. Improvements to the runoff *E. coli* values also had minimal impact on compliance. As shown on **Figure 6-11**, 90% of the daily samples at the discharge to Lake Michigan are in compliance with the single sample 235 CFU/100 mL standard over the entire recreational season.

## 6.3.2 Little Calumet River Baseline Water Quality Compliance

### 6.3.2.1 Typical Year *E. coli* Standard Compliance

The geomean of the model-predicted *E. coli* concentrations in the Little Calumet River for each month during the recreation season for the typical year under baseline conditions are provided in **Table 6-7**. **Figure 6-6** shows that some upstream segments of the Little Calumet River are always in compliance with the 125 CFU/100 mL standard under baseline conditions, while river segments downstream of the Deep River inflow are never or rarely in compliance (zero or one month during the seven-month recreation season). The geomeans for the Deep River and East Branch are above 125 CFU/100 mL for all months of the recreation season.

The percent of model-predicted *E. coli* concentrations (noon values) below 235 CFU/100 mL in the Little Calumet River is provided in **Table 6-8** for each month of the recreation season. **Figure 6-7** shows the percent of values meeting the single sample 235 CFU/100 mL standard over the entire recreation season. The results indicate that compliance worsens downstream of the Deep River and East Branch inflows.

Model predicted compliance with both the geomean and single sample standard for the baseline conditions in the Little Calumet River is summarized in **Table 6-9**. Samples exceed either the monthly geomean standard, single sample standard, or both. **Figure 6-12** shows the frequency distribution of the model-predicted *E. coli* concentrations (noon values) during the recreation season at the outlet to Lake Michigan, as well as at the segment downstream of the Deep River inflow and at the west end of the Little Calumet River. The results indicate that discharge from the Little Calumet River into Lake Michigan is in compliance with the single sample 235 CFU/100 mL standard for 63% of the recreation season under baseline conditions.

#### 6.3.2.2 Typical Year *E. coli* Standard Compliance with Improved Non-Point Sources

The results of the model simulation with improved non-point source conditions indicate that all segments of the Little Calumet River would be in compliance with the 125 CFU/100 mL geomean standard, as shown in **Table 6-10** and **Figure 6-9**. The improved NPS conditions were represented in the model by reducing the *E. coli* concentrations of the baseflow and runoff from catchment areas and tributary water bodies (Deep River, East Branch, and Willow Creek) to 63 CFU/100 mL.

Compliance with the single sample 235 CFU/100 mL standard also increases significantly in the Little Calumet River when the non-point sources are improved, as shown in **Table 6-11** and **Figure 6-10**. Discharge from the Little Calumet River into Lake Michigan would be in compliance for 96% of the total recreation season, compared to 56% with no NPS improvements (**Figure 6-13**). These results indicate that *E. coli* loads from the non-point sources have a significant impact on meeting the *E. coli* standards in the Little Calumet River, while the CSO discharges would have much less of an impact. The *E. coli* load contribution to the Little Calumet River from the CSO discharges is minimal compared to that from the non-point sources.

Model predicted compliance with both the geomean and single sample standard for the improved NPS simulation in the Little Calumet River is summarized in **Table 6-12**. Based on the model predictions, non-compliance with the water quality standards is due to exceedances of the single sample standard.

### 6.3.3 Water Quality Compliance Summary

The Grand Calumet River meets the geomean *E. coli* water quality standard at the discharge to Lake Michigan under current conditions. Non-point source loadings reductions have minimal impact on the compliance with the single sample standard compliance.

- The results indicate that all segments of the Grand Calumet River are in compliance with the 125 CFU/100 mL geomean standard under baseline conditions. The results indicate that *E. coli* counts meet the single sample standard in between 77% to 100% of the daily samples collected for each month during the recreation season under baseline conditions. Compliance with the single sample standard was highest during April and October and lowest during the month of July.

- Reducing the non-point source *E. coli* loads has a minimal impact on compliance with the water quality standards for the Grand Calumet River, since the majority of the baseflow, which is from US Steel, already has low *E. coli* values ranging from 10 to 30 CFU/100 mL. Improvements to the runoff *E. coli* values also had minimal impact on compliance. For single sample 235 CFU/100 mL standard, 90% of the daily samples at the discharge to Lake Michigan are in compliance over the entire recreational season.

The Little Calumet River does not meet *E. coli* water quality standards at the discharge to Lake Michigan under current conditions. Large improvements are seen when non-point source loadings are reduced.

- Some upstream segments of the Little Calumet River are always in compliance with the 125 CFU/100 mL standard under baseline conditions, while river segments downstream of the Deep River inflow are never or rarely in compliance. The results indicate that compliance worsens downstream of the Deep River and East Branch inflows. The simulated discharge from the Little

Calumet River into Lake Michigan is in compliance with the single sample 235 CFU/100 mL standard for 63% of the recreation season under baseline conditions.

- Reduction in non-point source loadings results shows the rivers almost meet water quality standards for *E. coli*. Non-compliance is due to exceedances for the single sample standard. The *E. coli* load contribution to the Little Calumet River from the CSO discharges is minimal compared to that from the non-point sources.

# Section 7

# Summary

This CSO Characterization Report is the culmination of approximately 15 years of effort by GSD to study its collection system, develop detailed hydraulic, hydrologic, and water quality models, flow and water quality data collection, model calibration and validation, and characterization of its system. During that time, GSD worked closely with IDEM, USEPA, and USDOJ to ensure that the methodology used during the process meets the 1994 USEPA CSO Control Policy requirements. GSD also engaged in an extensive receiving water use study and community outreach program to determine existing and proposed future uses of its receiving water bodies.

This report provides an extensive review of GSD's collection system and CSOs, the CSO receiving waters, the Little Calumet and Grand Calumet Rivers, and Lake Michigan to which the rivers are tributaries. A detailed Stress Test Report, documenting WWTP operations, bottlenecks, and planned improvements, is being submitted to the Agencies at the same time. Together, this CSO Characterization Report and the Stress Test Report form a solid foundation for the forthcoming efforts to identify, screen and evaluate CSO control alternatives and produce GSD's CSO Long-Term Control Plan.

## 7.1 Collection and Treatment System Performance and CSO Discharge Characteristics

The 1994 USEPA CSO Control Policy requires control of CSOs to a level sufficient to either (1) demonstrate post-implementation compliance with water quality standards (the "Demonstrative" Approach) or (2) achieve abatement of CSOs to a level sufficient to presume compliance with water quality standards (the "Presumptive" Approach), which includes the following three alternative control level targets:

- 85% capture of wet weather combined sewer flow by volume annually;
- The elimination or removal of the mass of pollutants that would be achieved by the above volume capture; or
- 4 to 6 system-wide overflow events annually.

Based on the calibrated collection system model, **Table 7-1** presents the model-predicted percent capture.

**Table 7-1. Model-Predicted Annual Percent Capture**

| Parameter | Model-Predicted Volume (MG) |
|---|---|
| Total System Inflow during Wet Weather | 10,940 |
| Total Satellite Flows during Wet Weather | 2,881 |
| Total CSOs to Receiving Waters | 405 |
| Total Flooding | 10 |
| WWTP treated Flows during wet weather | 10,492 |
| **% Capture** | **97.0%** |

**Table 7-2** presents the model predicted annual overflow frequencies per CSO.

**Table 7-2. Model-Predicted Annual Overflow Activations by CSO**

| NPDES Outfall Number | Outfall Location | Events/ Frequencies |
|---|---|---|
| **West Branch Little Calumet River** | | |
| 004 | 15th Avenue and Elkhart Street | 12 |
| 005 | 32nd Avenue and Broadway West | 5 |
| 013 | 25th Avenue and Louisiana Street | 13 |
| 015 | 32nd Broadway and Alley 1 East | 29 |
| | **TOTAL** | **29** |
| **East Branch Grand Calumet River** | | |
| 006 | Rhode Island Street at East Interceptor | 18 |
| 007 | Alley 9 at East Interceptor | 8 |
| 008 | Polk Street at East Interceptor | 25 |
| 009 | Pierce Street at East Interceptor | 6 |
| 010 | Bridge Street at East Interceptor | 14 |
| 011 | Chase Street at East Interceptor | 5 |
| 012 | Colfax Street at West Interceptor | 15 |
| | **TOTAL** | **25** |
| | **System-Wide TOTAL** | **29** |

**Note**: CSO 014 - 25th Avenue and Wisconsin Street – is filled with concrete and therefore not included.

Although the system well meets the annual percent capture requirements on a system-wide basis, the system is not meeting the annual activation frequency requirements at most CSO outfall locations. GSD therefore intends to identify and evaluate potential improvements to abate CSO impacts. The above listing will be used in the alternatives analysis to prioritize CSOs for abatement.

## 7.2 CSO Impacts on Water Quality and Water Quality Compliance

Extensive water quality data has been collected on the Grand Calumet River, Little Calumet River and along the Lake Michigan Shoreline by the GSD, including updated data in 2013.

This water quality data indicates that improvements in water quality conditions are required to meet standards for designated uses of the waterways. In particular:

- *E. coli* standard are exceeded in the Little Calumet River for both low and high flow conditions.
- *E. coli* standards have been historically exceeded in the Grand Calumet River.
- *E. coli* standards are exceeded along the Lake Michigan shoreline, resulting in beach closures. However, there does not appear to be correlation between wet weather (high river flow periods) and *E. coli* exceedances. Single sample criteria are more frequently exceeded for beaches to the west of the US Steel facility.

Therefore, the compliance status with water quality standards is as follows:

- The Grand Calumet River meets the geomean *E. coli* water quality standard at the point of discharge to Lake Michigan under current conditions. Model simulations show that non-point source loadings reductions have minimal impact on compliance with the single sample *E.coli* standard.
- The Little Calumet River does not meet *E. coli* water quality standards at the point of discharge to Lake Michigan under current conditions. Large improvements are predicted when non-point source loadings are reduced.

**Table 7-3** documents that CSOs from the GSD do not discharge to any Sensitive Areas, as defined by the Sensitive Area criteria of the 1994 USEPA CSO Control Policy.

**Table 7-3. Summary of Sensitive Area Evaluation**

| Sensitive Area Criteria | Little Calumet River (GSD CSOs – yes) | Grand Calumet River (GSD CSOs – yes) | Lake Michigan (GSD CSOs – no) |
|---|---|---|---|
| Outstanding National Resource Waters | None | None | Open waters of Lake Michigan |
| National Marine Sanctuaries | None | None | None |
| Threatened or Endangered species | None | None | None |
| Primary Contact Recreation | None | None | Shoreline beaches |
| Public Drinking Water Intakes | None | None | Multiple intakes |
| Shellfish Beds | None | None | None |

The analysis summarized above indicates that it is unlikely that the GSD CSOs directly impact Sensitive Areas or their associated waterbody uses. CSOs appear to impact water quality and beneficial uses in the Little Calumet River to a greater extent than those to the Grand Calumet River, although non-point sources also have a significant impact on water quality in the Little Calumet River.

## 7.3 Next Steps

The next steps in this process are outlined below:

- Technology / Alternatives Screening;
- Alternatives Analysis and Recommended Plan Evaluation, including Cost / Performance Analysis;
- Financial Capability Assessment, including Recommended Plan CSO Control Measures;
- Long Term Control Plan – Draft and Final;
- Public and Regulatory Agency Participation (throughout the process).

The schedule for the above-listed deliverables is contingent on approval of the CSO Characterization Report by USEPA and IDEM. GSD will use the detailed information developed as part of this CSO Characterization Report, as well as the Stress Test Report being submitted under separate cover, to develop a system-wide CSO LTCP to abate the impacts of CSO discharges to meet the objectives and requirements of the 1994 CSO Control Policy.

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# Appendix 7-1

# Response to USEPA's Comments on 7/17/2018 CSO Characterization Report, 1/31/2019

CDM Smith

## Memorandum

*To:* *Gary Sanitary District*

*From:* *CDM Smith Inc.*

*Date:* *January 31, 2019*

*Subject:* *Combined Sewer Overflow Characterization Report*
*Response to USEPA's Comments, dated 11/29/2018*

The United States Environmental Protection Agency (USEPA) submitted comments on Gary Sanitary District's (GSD's) 7/17/2018 Combined Sewer Overflow (CSO) Characterization Report, dated 11/29/2018. Subsequent to receipt of those comments, GSD held a comment discussion call with USEPA, IDEM, and USDOJ on 12/19/2018 to discuss each comment and find resolution to each.

This memorandum documents responses to those comments, as discussed during the 12/19/2018 call, all of which have been incorporated into the revised Characterization Report dated 1/31/2019.

Section 1 of the CSO Characterization Report has been revised to acknowledge receipt of USEPA's comments dated 11/29/2018, the comment review call held with USEPA on 12/19/2018, Appendix 7-1 was added to include this Response to Comments document, and Appendix 7-2 was added to include USEPA's 11/29/2018 Comment document itself.

1. Response to Comment #1:

   Table 2-1 was footnoted to explain that the total service area presented represents the boundary of Gary Sanitary District. This "service area" includes both sewered (combined, sanitary, and storm) and unsewered area. The unsewered area is not included on the table. Section 2.2 was revised to include this explanation as well.

   Section 2.3.1 was revised to remove the statement re: the percent of GSD's collection system that is combined. The statement was intended to refer to the sewers within the City of Gary. Table 2-1 accurately represents the acreage and percent of sewers within each system.

2. Response to Comment #2:

   Section 2.3.2 has been revised to reflect that GSD currently maintains and operates 27 pump stations. GSD owns 29 pump stations, of which two have been abandoned.

   Table 2-3 has been revised to correct typographical errors in Pump Stations 5, 7, 19, and 29.

3. Response to Comment #3:

   Section 2.3.3 has been revised to state that the elevations presented in Table 2-4 for the Bridge, Chase, and Colfax weirs are post-adjustment, and that the river weirs were not adjusted. Table 2-4 was also revised to include the 2008 (pre-adjustment) weir elevations.

4. Response to Comment #4:

   Section 2.3.3 Paragraph three has been revised to identify all six structures with a second downstream weir on the Grand Calumet River (Alley 9 CSO, Chase CSO, Colfax CSO, Pierce CSO, Polk CSO, and Rhode Island CSO).

5. Response to Comment #5:

   Table 2-4 was revised to add the following explanation re: CSO 014: CSO 014 - 25th Avenue and Wisconsin Street - is filled with concrete and not included in the table. It is located upstream of a pump station in Gary's Marshal Town subdivision. During an Army Corp levee project, the levee raised the water level to the point where water was backflowing into CSO 014 and flooding the upstream neighborhood. To prevent that from happening, GSD closed the CSO with concrete. However, GSD does not want to remove the CSO from its NDPES permit because that would require significant cost, effort, and coordination with the Army Corps. Additionally, GSD would like to retain CSO 014 as a permitted CSO outfall in case of emergency. During the 12/19/2018 call with USEPA, IDEM, and DOJ, it was agreed upon that CSO 014 will remain in GSD's NPDES permit for now and it will be evaluated as part of the alternatives analysis.

6. Response to Comment #6:

   Table 2-4 has been revised. The column "Receiving Water" was removed, the CSOs have been grouped by Receiving Water Body, and the description of the receiving water body matches the description in GSD's NPDES permit.

7. Response to Comment #7:

   Table 2-4 has been revised to remove the internal regulator that was labeled as "n/a". That diversion structure is internal to the system and is not a CSO outfall.

8. Response to Comment #8:

   Section 2.5 has been corrected to read "anaerobic and aerobic zones" and further revised to explain that primary effluent is distributed to bioreactors consisting of anaerobic and aerobic zones (A/O process configuration) for the removal of particulate BOD, soluble BOD, ammonia and phosphorus. There are six bioreactors; the first 1/3rd of the first pass of each bioreactor is operated anaerobically, while the remainder of each bioreactor is operated aerobically.

9. Response to Comment #9:

   Sections 2.5.2 and 2.5.3 have been revised to clarify the unit process maximum treatable flow and which unit processes have firm capacity requirements.

10. Response to Comment #10:

    Table 2-6 has been updated to reflect current maximum treatable flow. It should also be noted that it is GSD's intent to explore maximizing flow to the WWTP during the alternatives analysis.

11. Response to Comment #11:

    Section 2.6 has been revised to explain that GSD records peak hourly and average daily flow at the WWTP, and average daily flow for its satellite communities at each connection. Therefore, peaking factors for the satellite communities cannot be provided.

12. Response to Comment #12:

    Section 2.7 has been revised to provide explanation that none of GSD's SIUs are CIUs. Figure 2-3 presents the location of each SIU relative to the CSOs. Additional explanation has been provided re: Beaver Oil Company and US Steel.

13. Response to Comment #13:

    Section 2.7 has been revised to acknowledge that GSD does hold discussions with its SIUs as part of its pretreatment program on the implementation of Nine Minimum Controls.

14. Response to Comment #14:

    Section 2.7 has been revised to reflect that GSD has 14 SIUs in its service area.

15. Response to Comment #15:

    Section 3.2.2.2 has been revised to include the citation for the statement re: the Grand Calumet River within Illinois is designated as incidental contact recreation waters (35 Ill. AC 303.225).

16. Response to Comment #16:

    Section 3.1.3 has been corrected to state that "Four states, Wisconsin, Illinois, Indiana, and Michigan, share the 1,638 miles of shoreline. There are 45 miles within the State of Indiana (Tetra Tech 2004).".

17. Response to Comment #17:

    Section 3.3 has been corrected to reference USEPA.

18. Response to Comment #18:

    Section 3.2.2.3 has been revised to correct the typographic error in the standard for open waters in the Lake which should be listed as 20 cfu/100 mL.

19. Response to Comment #19:

    As indicated in the paragraph preceding Table 3-2 in the text, the Illinois 303d listings for Calumet Park Beach are from the Illinois Integrated Water Quality Report and Section 303(d) List, 2016, submitted to the USEPA on July 11, 2016. Most of the study area for the Characterization Report, as defined Consent Decree (see Section 3.1), is within the state of Indiana with the exception of Calumet Park in Illinois.

20. Response to Comment #20:

    As described in response to Comment 21, fecal coliform has been added to the discussion of potential pollutants of concern for this study to Section 3.6.1.

    Fecal coliform was not added initially because Calumet Park, which is the only portion of the study area within Illinois, has a TMDL for *E. coli.* A query of the EPA STORET for fecal coliform data collected within the last 20 years for this location (Calumet Park) did not identify any data. As stated in Lake Michigan Beaches Bacteria TMDL and Implementation Plan Phase II (see excerpt below) for this portion of the lake shoreline, even though Illinois has a fecal coliform standard, *E. coli* was used for development of the TMDL because of federal criteria for the Great Lakes, current beach monitoring practices based on *E. coli,* actual health impacts and because corrective actions that address *E. coli* will address fecal coliform.

    > "State criteria for fecal coliform for non-open waters in Lake Michigan are found in Illinois Administrative Code Title 35 Section 302.505. Federal criteria for *E.* coli were promulgated for Great Lakes coastal recreation waters in 2004 in the Final Rule for Water Quality Standards for Coastal and Great Lakes Recreation Waters and are codified in 40 CFR 131.41 Subp. D. The 2004 Federal *E .coli* criteria apply to the Illinois Lake Michigan beaches (and other coastal and Great Lakes waters) that are designated for swimming, bathing, surfing, or similar water contact activities. The federally promulgated standards also apply to existing State bacteria standards for recreation waters. While both standards in Table 3-3 apply to the Lake Michigan shoreline segments addressed in this TMDL, IEPA selected the E. coli criteria for use in developing the TMDL.
    >
    > The *E. coli* standard was selected for the TMDL for multiple reasons. First, beach managers monitor for and make swim ban decisions based on Federal *E. coli* standards. Second, the *E. coli* and fecal coliform numerical criteria are based on detectable effects between decreasing water quality and increasing risk to gastrointestinal illness. When the 1986 criteria values were developed for *E. coli* the illness rate associated with the GM was determined to be 8 out of 1000. However, studies indicate illness rates are more accurately

predicted by *E. coli* than fecal coliform (Dufour, 1984). Lastly, it can be reasonably assumed that corrective actions to reduce bacteria at beaches will reduce both E. coli as well as fecal coliform counts, given that *E. coli* is one of many fecal bacteria comprising the fecal coliform group."

Excerpt from RTI International, Research Triangle Park, Environmental Consulting & Technology, Inc. and Clinton Township, MI. 2013. Lake Michigan Beaches Bacteria TMDL and Implementation Plan. Phase II. Report prepared for U.S. Environmental Protection Agency. Retrieved from http://www.epa.state.il.us/water/tmdl/report/lake-michigan-beaches/final-chicago.pdf

The observed *E. coli* data was assessed by comparing that data to Indiana's recreational use 235 counts /100 mL single sample maximum because many locations lack sufficient data to calculate a geomean.

21. Response to Comment #21:

    a. Response to Comment #21a:

       Section 3.6.1 was revised to include fecal coliform as a POC, and explanation was added that:

       The flow in the Little Calumet River west towards Illinois is dominated by flows from Hart Ditch. Current receiving water modeling does not indicate that *E. coli* bacteria from CSOs are transported to the west. Since *E. coli* is a subgroup of fecal coliform and *E. coli* loads from the CSOs are not shown to flow west, fecal coliform will not be retained as a potential pollutant of concern for this study.

       PCB contamination in Indiana waterways is a statewide problem due to historical waste disposal. Water quality data for PCBs is not available for the CSO discharges or the wastewater plant influent and effluent to characterize the CSO discharges. The GSD does analyze samples from bar screening grit and digested sludge to allow for appropriate disposal of these solids. Results from the last three years of data (January 2016 through November 2018, had low levels of PCB concentrations ranging from non-detect up to 25 mg/Kg. Samples from the sludge had the lowest concentrations with a maximum PCB concentration of 2.4 mg/Kg. For perspective, PCBs concentrations must be below 50 mg/Kg to allow for disposal in a non-hazardous waste landfill. These data suggest that current flow streams in the sewer system (including CSO discharges) do not transport significant PCB loads, but rather legacy waste disposal practices are the source of PCB contamination in area waterways.

    b. Response to Comment #21b:

       Section 3.6.2 was revised to include further information on the cyanide, oil and grease, and PCB information.

22. Response to Comment #22:

    Table 5-1 was renamed to "Collection System Model Updates".

23. Response to Comment #23:

    Section 5.1 was revised to explain further GSD's HGL reduction operational change in that GSD has greatly reduced the HGL in the 84-inch interceptor by minimizing the WWTP raw sewage pumping wet well level to the least amount without inducing pump cavitation.

24. Response to Comment #24:

    Section 5.5 was revised to remove the statement re: the "conservative" nature of the model.

25. Response to Comment #25:

    Section 5.4 was revised to acknowledge that the alternatives analysis will evaluate both percent capture and annual overflow activations. Additionally, explanation was added re: the 110% threshold for defining wet weather flow, as the flow includes infiltration and inflow which could last for a day after rainfall occurs.

26. Response to Comment #26:

    Section 6.1 was annotated to explain that the typical year rainfall record rainfall record was used for the non-CSO areas. The rainfall record from 1986, as recorded at the South Bend, Indiana gauge, was selected for the typical year rainfall record as described in the Final Long Term Control Plan Typical Year Determination and Baseline Conditions and Modeling Memorandum (CDM Smith 2012).

27. Response to Comment #27:

    Section 6.3 was revised to clarify that the 235 CFU/100 mL standard is applied as the maximum permissible value. Further discussion was added to the description of Table 6-2 and Figure 6-8 to clarify the interpretation of these tables and figures.

28. Response to Comment #28:

    Section 6.3 was revised to state that the LTCP will include analysis of additional alternatives including the elimination of all CSOs to the receiving waters.

29. Response to Comment #29:

    GSD has provided all available information and analyses on the impact of its CSOs to Sensitive Areas. As shown in Table 7-3, the GSD's CSO outfalls do not discharge to Sensitive Areas. The discussion has been modified to indicate that CSOs do not directly impact the Sensitive Areas.

# Appendix 7-2
# USEPA's Comments on 7/17/2018 CSO Characterization Report, 11/29/2018

CDM Smith

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 5
77 WEST JACKSON BOULEVARD
CHICAGO, IL 60604-3590

NOV 2 9 2018

REPLY TO THE ATTENTION OF:

**CERTIFIED MAIL and ELECTRONIC MAIL**
**RETURN RECEIPT REQUESTED 7016 3560 0000 4829 7675**

WC-15J

Mr. Daniel F. Vicari
Executive Director
Gary Sanitary District
3600 West 3rd Avenue
Gary, Indiana 46402

Ms. Niquelle Allen Winfrey
City of Gary Corporation Counsel
401 Broadway
Gary, Indiana 46402

Subject: Gary Sanitary District's Combined Sewer Overflow Characterization Report Disapproval and Comments

Dear Mr. Vicari and Ms. Winfrey:

Enclosed is the U.S. Environmental Protection Agency and the Indiana Department of Environmental Management's (IDEM's) (our) response and comments to Gary Sanitary District's (GSD) Combined Sewer Overflow Characterization Report dated July 17, 2018. Based on the significant comments included in the attachment, we disapprove the submission, per Section XIX of the Consent Decree. Please review the comments and provide a revised submission within 45 days of receipt.

Thank you for your efforts to protect water quality. If you have any questions or concerns regarding this letter, contact Andi Hodaj of my staff at (312) 353-4645 or, at hodaj.andi@epa.gov.

Sincerely,

Patrick F. Kuefler, Chief
Water Enforcement and Compliance Assurance Branch

Enclosure

**SUBJECT: EPA and IDEM Comments on GSD's Combined Sewer Overflow Characterization Report dated July 17, 2018.**

**<u>Comments on specific sections of the report</u>**

**Section 2**

1. Table 2-1 summarizes the service area of GSD and its satellite communities. In the table, for the City of Gary, combined + sanitary + storm sewer = 18,490 acres while the total service area is 32,000 acres. In the same table, GSD states that the City of Gary is 35% combined sewer, however, in Section 2.3, it is stated that "approximately 93% of the GSD collection system sewers is in combined areas." GSD should clarify this table and explain why total areas do not match for the individual entities.

2. Section 2.3.2 notes that GSD operates and maintains 29 pump stations. According to Table 2-3, it appears that number is 27 – two stations are listed as abandoned (35th and Washington, and 48th and Carolina). It appears the calculation of the following pump sizes/capacities are incorrect: #5 pump size should be 6,600; #7 total capacity should be 846; #19 total capacity should be 564; and #29 total capacity should be 24,000. The Regulators request that GSD confirm and correct pump station capacities in Table 2-3.

3. Section 2.3.3 describes the CSO outfalls and regulators. The section notes that weir adjustments have been made at three locations (Bridge, Chase, and Colfax). Table 2-4 presents regulator information. GSD should clarify whether the elevations presented in that table for the three noted locations are post-adjustment, and whether at Chase, it was the river weir that was adjusted.

4. Paragraph 3 in section 2.3.3, states that six structures have a second downstream weir, but only five are identified in parentheses. GSD should confirm.

5. Table 2-4 states that CSO 014 is closed, but it is still identified in GSD's NPDES permit. If that is the case, GSD should request a modification to remove this outfall from the permit.

6. GSD should revise receiving water descriptions to match those in the NPDES permit only if the permit is correct. If not, then issue should be taken up with IDEM to correct the permit.

7. Table 2-4 has an outfall number identified as "n/a." Is this an internal regulator structure?

8. Section 2.5 describes GSD's wastewater treatment plant (WWTP). The description indicates that GSD's secondary aeration basins have "anaerobic and anoxic zones." Presumably there are also aerobic zones in the reactors; GSD should confirm. Specifically, the report should explain what activated sludge process GSD employs in its secondary system.

9. Section 2.5.2 discusses wet weather operations at the WWTP. GSD notes that the firm rated capacity of the secondary system is 142 MGD on a maximum day basis. GSD notes that a number of solids handling issues limit the plant's maximum day flow to 142 MGD, even on a "all units in service" basis; which is not consistent with the definition of "firm capacity." It is further noted that two processes have more significant capacity limitations. The first is the trash rack, and the second is the tertiary filters pumps – both are limited to 130 MGD flow rates. Above 130 MGD, excess flow is bypassed around each of these units. Is bypassing done on a regular basis, or was this only done during the stress test? Is there space within the current WWTP configuration for addition of increased pumping capacity?

10. Table 2-6 presents a summary of WWTP unit process capacities. It is noted that expansion of the plant's maximum hourly and daily capacities, by addressing identified issues, should be a component of GSD's Alternative Evaluation. GSD should consider such a maximization as an "early action" project.

11. Table 2-7 presents flow statistics for the GSD WWTP and for each of its primary satellites for years 2013 through 2017. If the satellite flow values are accurate and represent the total flows from each satellite, then GSD's satellites appear to have relatively limited wet weather peaking factors. GSD should provide peaking factors for each of its satellites.

12. Section 2.7 presents a list of Significant Industrial Users (SIUs). No discussion of the SIUs is provided; however, the table indicates none are categorical industries (CIUs). USS Corporation, as a SIC 3325 facility (steel foundry) would seem to possibly be a CIU. GSD does note that mercury is a pollutant of concern at USS Corporation and at Stericycle (where zinc is also of concern). GSD should confirm the CIU status of all the listed industries, and should discuss all identified IU-related pollutants of concern and their possible impact on its receiving waters.

13. GSD should also include a discussion in Section 2.7 of any measures, such as asking batch dischargers to hold during wet weather, that GSD has instituted to reduce IU impacts on CSOs.

14. In Section 2.7, it is stated that GSD has identified 12 SIUs, however, Table 2-8 presents 14 SIUs.

**Section 3**

15. In Section 3.2.2.2 GSD notes that the Grand Calumet River is designated for incidental contact recreation in Illinois. Please provide a citation for the source of the information.

16. There is a typo in the first paragraph of Section 3.1.3; five states should be four.

17. There is a typo in the first paragraph of Section 3.3; U.S. EPA instead of U.S. IEPA.

18. Section 3.2.2.3 states that the Illinois standard for the Open Waters of Lake Michigan must meet a five sample geomean of no more than 200/100ml Fecal coliform. The actual standard is 20/100 ml for open waters in the Lake.[1]

19. The presentation of stream designations is unclear, as it is not broken up by state, and largely addresses Indiana rather than Illinois. A table of 303d listings (2016)[2] is presented, which includes only one Illinois listing for Calumet Park. Please provide a citation for the source of the information.

20. Section 3.5 provides an assessment of the water quality data. GSD indicates that data for the pollutants included in the 303d listings (2016) and in the various TMDL was assessed. It is noted that only E. coli, not fecal coliform, is listed for each water body. Given that Illinois bacterial standards still include fecal coliform, consideration of fecal coliform data in Illinois waters appears to be appropriate. It is also noted that GSD indicates that E. coli data was assessed by comparing that data to Indiana's recreational use 235/100ml single sample maximum.

21. Section 3.6 presents the Pollutants of Concern (PoCs) GSD has identified in each receiving water. Potential PoCs were identified for each water body based on 2016 303d listings and applicable TMDLs.

    a. For the Little Calumet River, E. coli, Dissolved Oxygen (D.O.), Total Suspended Solids (TSS), Total Phosphorus (TP) and PCBs were identified as possible PoCs. GSD notes that PCBs are "not associated with existing discharges from the GSD." GSD should provide additional support and discussion of this statement. As a portion of the Little Calumet River flows into Illinois, fecal coliform should also be included in this list.
    b. For the Grand Calumet River, E. coli, Dissolved Oxygen (D.O.), Total Suspended Solids (TSS), Total Phosphorus (TP), Ammonia, Oil & Grease (O&G), Cyanide and PCBs were identified as possible PoCs. GSD notes that a 2004 U.S. Army Corp of Engineers (USACOE) TMDL indicated that cyanide, O&G and PCBs are "likely related to sediment and will be addressed by ongoing sediment remediation activities." GSD should indicate whether its WWTP influent data or CSO data has revealed significant concentrations of these pollutants.

**Section 5**

22. Table 5-1 is labeled "Validation Storm Event Statistics;" however, Section 5.1 and the table's content indicate it lists 2013 H&H Model updates.

23. Section 5.1 notes that GSD has decreased the hydraulic grade line (HGL) in the main interceptor by 1 foot to provide storage during wet weather events. As the additional one foot is below the pipe crown, the amount of storage provided is likely minimal. GSD

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[1] See Illinois Administrative Code Title 35, Section 302.505

[2] Clean Water Act Section 303d lists of impaired waters

should quantify the storage volume provided, and explain why it has not lowered the interceptor dry weather operating level further.

24. Table 5-5 presents model-simulated baseline Typical Year (TY) CSO discharge volumes, durations and frequencies. Total average volume is 405 MG, over a maximum discharge frequency of 29 events. Table 50-8 presents metered CSO volumes and events for the years 2013 through 2017. Total yearly CSO volumes ranged from 345 MG to 1,257 MG, with an average of 689.8 MG. GSD's assertion that its CSOs are difficult to meter notwithstanding, these statistics do not suggest that the model is conservative.

25. Section 5.4 presents a discussion of GSD's baseline percent capture of wet weather flow. GSD's analysis indicates that the baseline capture is 97%. This unlikely result appears to be at least in part due to the manner in which GSD has defined "wet weather flow." GSD has considered any day in which the daily flow was 110% of the annual average to be "wet weather" regardless of whether rainfall occurred. This results in 168 days, or 46% of the days in the year being considered wet weather. GSD should evaluate percent capture by considering only days with actual wet weather flow.

**Section 6**

26. Section 6.1 notes that rainfall data from the South Bend, Indiana gauge was used to simulate runoff in the non-CSO portions of GSD's service area. GSD should discuss why the typical year rainfall record was not used for these areas.

27. Section 6.3 discusses CSO discharge impacts on downstream Sensitive Areas (Lake Michigan). The discussion of each water body /pollutant combination focuses on the percentage of samples that exceeded the relevant water quality standard, without discussing the range of observed values, averages, etc. In considering compliance with Indiana's E. coli "daily max" standard, it appears that GSD may be miss-applying an allowance in Indiana Department of Environmental Management's E. coli standards that allows up to a 10% exceedance of the single day standard only where E. coli exceedances are "incidental and attributable solely to E. coli resulting from the discharge of treated wastewater from a wastewater treatment plant." That exemption would clearly not apply to GSD's impact analysis.

28. In Section 6.3, GSD also considered the impact of CSOs in concert with reduced non-CSO loads. GSD should also have considered the reduction of impact if CSOs were eliminated and non-CSO sources remained the same.

**Section 7**

29. GSD's conclusion that it is unlikely that its CSOs impact Sensitive Areas or their associated water body uses is not adequately supported by this report. GSD is requested to provide all available information and analyses supporting this assertion.